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THE BOTANICAL GAZETTE

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In the September number will appear:

The regulatory formation of mechanical tissue, by DR. F. C. NEWCOMBE, *University of Michigan, Ann Arbor.*

A full report of the proceedings of the Botanical Society of America, Section G (Botany), A. A. A. S., and the Botanical Club, A. A. A. S.

Noteworthy anatomical and physiological researches.

BOTANICAL GAZETTE

AUGUST, 1895.

Synopsis of North American Amaranthaceæ. III.

EDWIN B. ULINE AND WILLIAM L. BRAY.

FRŒLICHIA Moench. Meth. **1:** 50. 1794.

Annual or perennial cinereous-pubescent herbs with opposite leaves and opposite or whorled spikes, flowers subtended by three scarious bracts (the laterals strongly imbricated), the densely woolly calyx tubular, cleft into five scarious lanceolate lobes, two of them becoming prominently winged or toothed below, the remaining three more or less tuberculate or smooth, all indurated in maturity and enclosing the thin indehiscent utricle, the filaments united into a tube bearing the five oblong anthers in the sinuses of the strap-shaped lobes, style capitate or lobed.

The original generic name *Frœlichia* of Moench was restored by Moquin-Tandon in 1849, replacing *Oplotheca* Nutt. (*Hoplotheca* Spreng.), which, though not the only name since assigned to the group was most generally adopted at that time.

Moquin's primary sections HOPLOTHECA and DILOPHA, with stigmas capitate in the one case and penicillately lobed in the other, suggests a distinction so deep-seated as to seem at first more than specific in comparison with the very trivial distinctions of the species coordinated under these respective sections. Such an opinion is expressed in Bentham & Hooker Gen. Pl. **3:** 41. But further study has shown that here, as is so often true of the older botanists, the breaking-up process has been carried too far. For example, Moquin presents five species under the section HOPLOTHECA, though the one set of characters alone which may with any degree of facility be laid hold of in this polymorphous group is, on the one hand, the unfailing presence of prominent, distinct, dorsal teeth on the

sepals of the fruiting calyx, designated by Holzinger as the *gracilis* group (Contr. Nat. Herb. **1**: 213), and, on the other, a coalescence of the teeth in such a way as to form a broad wing, leaving only a serrate or crenulate margin to mark their origin. On this basis, then, we venture to act upon Holzinger's suggestion and reduce our five native forms of the section HOPLOTHECA to two species.

The section DILOPHA as we have seen it, though considerably divergent in its stigma character, is in most respects so intimately related to the HOPLOTHECA species as to preserve its specific relation to them. Since its habitat is restricted to tropical South America, we may limit its discussion in this paper to the suggestion that here, as in HOPLOTHECA, further study may likewise result ultimately in reduction of the number of species.

1. F. FLORIDANA (Nutt.) Moq. DC. Prodr. **13**^{2}: 420. 1849.
Oplotheca Floridana Nutt. Gen. Am. **2**: 79. 1818.
O. gracilis Hook. Ic. Pl. sub *pl. 256*. 1837–1854.
F. gracilis Moq. l. c.
O. Texana A. Br. Ann. Sci. Nat. III. **13**: —. 1849.

Stem slender, leafless above, varying in height from a few centimeters to 9^{dm}: leaves very variable in size, linear-lanceolate to ovate acute, mostly attenuate at base: bracts often becoming black in age: fruiting calyx ovate; dorsal crests dissected into distinct rigid irregular teeth.—From Georgia, Florida and the Gulf states throughout Texas, where it is most abundant, westward to Chihuahua, reaching its northern limits in Colorado, Nebraska, Wisconsin and Illinois. It does not appear to be found east of Illinois in the northern states.

While there is one unbroken transition series from certain minute specimens from southwestern Texas of Bigelow's collection, some of which are less than 3^{cm} high, to the leafier taller forms of the original *F. Floridana*, making it impossible to draw definite boundary lines at any point in this ascending scale, it yet appears that the proportion of intermediate forms is small, so that two groups, based almost solely on the size of the plant would seem to present themselves; though in our opinion this is not sufficiently justifiable ground for permitting them to remain separate. Mr. Holzinger arrives at a similar conclusion, but in preserving the name *gracilis* he has overlooked the priority of *Floridana*. See also Torrey in Pac. R. R. Rep. **4**: 131, where the same conclu-

sion is reached. A specimen in the Gray herbarium, cultivated in 1848 from Texas seed, is peculiar in its glabrate habit, with very long narrow leaves, some of which are over 17^{cm} long. It has not the appearance of *F. Floridana*, but its crest characters show very close affinities for this species, in view of which we have tentatively classified it here.

Type in Nat. herb. (?). The uncertainty here lies in the fact that the label on this specimen is not identical with Nuttall's familiar little square labels, and the words "garden specimen" are added, though "Banks of the Altamaha, *Nuttall*," would indicate that the specimen is of no slight importance.

F. FLORIDANA DRUMMONDII (Moq.).

F. Drummondii Moq. l. c. 421.

Plant taller and stouter, tawny-sericeous, with larger oblong-elliptical leaves: teeth of the sepal crests unequally united, in this regard passing into the next species.—Southwestern Texas and northern Mexico. Types in herb. Gray (*Berlandier*, 2001) and herb. Columbia College (*Drummond*, 326 ?). The latter was published in Torr. & Gray's Fl. N. Am. as *Oplotheca Floridana*. It is probable that it is one of Drummond's types, though Moquin makes no mention of the collection number.

2. F. INTERRUPTA (L.) Moq. l. c. 421.

Gomphrena interrupta L. Sp. Pl. 2: 224. 1753.
Celosia procumbens Jacq. Misc. 2: 344. 1781.
Gomphrena spicata Lam. Encycl. 1: 120. 1791.
Frœlichia lanata Moench Meth. 1: 50. 1794.
Lophocarpus interrupta Link Diss. Bot. Suerin. 52. 1795.
Oplotheca interrupta Nutt. Gen. Am. 1818.
Ninanga interrupta Raf. Fl. Tellur. 3: 76. 1836.
Frœlichia alata Wats. Proc. Am. Acad. 21: 437. 1886.

Plant variable as in *F. Floridana* and not essentially distinct in habit from it: fruiting calyx ovate; teeth of the crest coalescent into a thin continuous broad wing which is usually erose-denticulate.—Arizona, Chihuahua, Sonora and Lower California, rare. *Palmer* and *Pringle* specimens in herbaria labelled *F. interrupta* prove to be *F. Floridana*. Type unknown.

If the absence of secondary crests which are invariably seen to appear on the mature fruiting calyx in the form of horny tubercles or nascent wings were to be accounted for on any grounds other than immaturity, it would be possible to recog-

nize Watson's *F. alata.* But we have been forced to abandon this as an unreliable character. Hence, it develops that the affinities of Watson's plant are here and not, as he supposed, with *F. tomentosa.*

F. INTERRUPTA **cordata,** var. nov.

Frœlichia Texana Coult. & Fisher, Bot. Gaz. **17**: 350. 1892.

Fruiting calyx fuscous, broad (broader than long), cordate, with broad crenate wings.—Western Texas. Types in herb. Coulter and J. D. Smith (Pena, *Nealley*, 421, referred to *F. Floridana* Moq. in Contr. Nat. Herb. **1**: 48), and herb. Gray (*Wright*, 591, from western Texas). The name *Texana* is abandoned because of its preemption as a specific name under *Oplotheca* (see synonymy of *F. Floridana*).

GOSSYPIANTHUS Hook. Icon. **2**: 251. 1840.

Procumbent and diffusely branching woolly herbs from a perennial root-stock, with thick, more or less silky-woolly leaves, the radical ones varying from linear-spatulate to obovate-spatulate or ovate-oblong, small axillary heads of perfect flowers, three delicate scarious bracts, five equal acute three-nerved very pilose sepals, five stamens united into a cup at base, short style and emarginate two-lobed stigma.

This genus is frequently confused with *Guilleminia,* which it closely resembles in aspect. It may be distinguished at a glance by the invariable presence of the rosette of radical leaves and the more conspicuously pilose flowers.

1. G. LANUGINOSUS (Poir.) Moq. DC. Prodr. **13**^{2}: 337. 1849.

Paronychia lanuginosus Poir. Encycl. Suppl. 4: 303. 1816?
G. rigidiflorus Hook. l. c. 1840.
G. tenuiflorus Hook. l. c. 1840.

Branching from the short thick root-stock: leaves generally pilose above and silky-canescent beneath, but often both surfaces becoming glabrate; the radical ones numerous in a flat rosette, varying in length from 2 to 7^{cm}, persistent, sub-coriaceous; the cauline ones smaller (4 to 10^{mm} long) spatulate-orbicular, obovate, ovate or lanceolate, opposite: bracts ovate-lanceolate: flowers densely covered with jointed hairs: sepals usually narrowly lanceolate, acuminate, with three prominent green nerves, scarious on the margin: filaments usually dilate: pistil equalling or surpassing the stamens.—Indian Territory, southward throughout central and western Texas, westward to Chihuahua, and reported as ex-

tending southward into Mexico (Hemsley Biol. Centr. Am.) and from the West Indies (Moq. l. c.). The only specimen in our possession found west of El Paso, Tex., was collected by Pringle near Chihuahua, Mex. While it may occur in the intervening regions, it is probably quite rare west of Texas. Type unknown.

G. LANUGINOSUS **Sheldoni,** n. var.

Plant more robust throughout: cauline leaves larger: flowers rigid, flat on the ventral side: bracts short orbicular: sepals destitute of chlorophyll, not scarious margined.—Collected in July, 1891, near Cash Creek, Indian Territory, by C. S. Sheldon (no. 170). Types in Nat. herb. and herb. Gray.

In merging *G. rigidiflorus* with *G. tenuiflorus* we have simply confirmed the suggestions of Dr. Watson (Proc. Am. Acad. **18:** 144) and of Dr. Torrey (Bot. Bound. 180). Furthermore, there is no doubt that Moquin's *G. lanuginosus* must also be included here. Hooker f. in Benth. & Hook. Gen. Pl. **3:** 37, 39 referred *Gossypianthus lanuginosus* Moq. to *Guilleminia*, briefly characterizing it by the narrower lobes of its perianth. Even if the transfer were correct, this difference would scarcely be counted of specific importance in a group of so keen susceptibility to variation as is everywhere prevalent in the *Amaranthaceæ*. But a critical study of Moquin's description of *Gossypianthus lanuginosus* discloses the fact that it is quite distinct from *Guilleminia densa* Moq. in the presence of a rosette of radical leaves and of distinctly 3-nerved acute sepals, both of which are characteristic of *Gossypianthus*. It is not probable, moreover, that so critical an observer as Moquin-Tandon should have committed the error of confusing two genera so distinct in floral character. Still more conclusive is the fact that no *Guilleminia* with 3-nerved sepals has been found in any of our larger herbaria, though definite statements are made about its range in Coulter's Botany of Western Texas, and in Hemsley's Biol. Centr. Am. Since the name *Gossypianthus lanuginosus* does not appear in our herbaria, the only reasonable explanation is that the facts of range were taken from the original *Paronychia lanuginosa*. *Guilleminia lanuginosa* Hook. f., then, so far as it pertains to our own boundary region is fictitious; and the plants in question that have been referred to under the name must be looked for in the herbaria among the material labelled *Gossypianthus rigidiflorus* and *G. tenuiflorus*.

Specific lines had been drawn chiefly on relative length of bracts, relative length of stamens to the pistil, and on slight differences in the shape of the filaments. The first two prove to be dependent upon age of specimen, while the last point seems in most cases to be wholly without foundation.

GUILLEMINIA HBK. Nov. Gen. et Sp. **6**: 40. *pl. 518.* 1823, non Neck. Elem. **2**: 132. 1790.

Habit very similar to *Gossypianthus* with opposite cauline leaves connate at base, the radical ones few, long spatulate, not persistent, dense leafy axillary flower clusters, minute scarious woolly flowers, three oblong delicate bracts, campanulate 5-lobed calyx with obconic tube, five stamens inserted at the mouth of the tube opposite the calyx lobes, short style with emarginately 2-lobed stigma and translucent seed.

The presence of radical leaves in mature specimens is very rare, having been observed only once among fifty specimens. They differ from those of *Gossypianthus* in their delicate texture, and so withering and disappearing before the flowering period.

Necker's *Guilleminia* is a synonym of *Votomita* Aubl. (1775), an ill-defined genus of the *Cornaceæ*. The present acceptance of the law of synonyms would suggest that the name might be justifiably abandoned; and this course would now be taken if the retroactive force of this law were not still an open question. But in view of its continued agitation and the probable final rejection of the "retroactive" principle, we have adopted the more conservative plan of retaining the present name.

1. G. DENSA (Willd.) Moq. DC. Prodr. **13**^{2}: 338. 1849.

Illecebrum densum Willd. Roem et Schult. Syst. 5: 517. 1819.
G. illecebroides HBK. l. c. 1823.
G. densa alsinefolia Moq. l. c. 1849.
Achyranthes piloselloides Poit. ex Moq. l. c.

Leaves spatulate to ovate or lanceolate, minute, punctate, mostly bright green and glabrous above, pilose-pubescent below: bracts sub-equal: calyx lobes oblong, obtuse, 1-nerved. —Western Texas, Southern Arizona and New Mexico, extending southward into tropical America. It has been found as far south as Bolivia. Type unknown.

G. DENSA **aggregata,** n. var.

Plant larger with flowers and leaves densely aggregated on the long stout branches. Southern Mexico.

Types: Near Mexico, "Bustamenta y Rocha," in herb. Columbia College; Jalisco, Guadalajara, (*Palmer* 47 in 1886) in herb. J. D. Smith, Columbia College and Nat. herb.

CLADOTHRIX Nutt. ex Moq. DC. Prodr. **13**[2]: 359. 1849.

Low herbaceous annuals or suffruticose perennials with opposite small (often very minute) rounded or oblong leaves, which, together with the branches, are more or less encased in a felt-like tomentum of verticillately branched hairs, slightly or deeply imbedding the small scattered axillary perfect flowers, three concave hyaline bracts, five equal, oblong sepals, filaments coalescent at base into a short cup with small staminodia present (or none), large oblong 1-celled anthers and deeply 2-cleft subsessile stigma.

The genus presents very close affinities with *Alternanthera*, section "*simple staminodia*," but when it is considered that the prevailing and typical representatives of the genus are mostly destitute of staminodia, that these staminodia when present are relatively much smaller than those of *Alternanthera*, and that the general plant habit with its stellate tomentum has no equivalent in that section of *Alternanthera*, (*A. stellata* (Wats.) having laciniate staminodia), it at once becomes apparent that the genus *Cladothrix* stands on safe ground apart from *Alternanthera*.

* *Herbaceous, annual, mostly prostrate.*

1. C. LANUGINOSA Nutt. ex Moq. l. c. 1849.

Achyranthes lanuginosa Nutt. Trans. Amer. Phil. Soc. N. S. 5: 166. 1820.

Alternanthera lanuginosa Torr. in Emory's Rep. 150. 1848. Moq. in DC. Prodr. 13[2]: 359. 1849.

Very various as to habit and foliage, mostly prostrate, but sometimes ascending, densely or sparingly tomentose (becoming glabrate): branches loosely spreading (or often densely diffuse): leaves round, tapering into a petiole, or minute elliptical when crowded: flowers mostly exposed with the scarious yellow sepals longer than in the other species: stamens either very unequal with no staminodia or equal with very short obtuse lobes between the filaments.—The most widely distributed species of *Cladothrix*, apparently abundant from

Kansas and Arkansas through Texas to Arizona and throughout northern Mexico. Type in herb. Columbia College.

***Mostly suffruticose, perennial, ascending or erect.*

+ Staminodia (alternating lobes) very short and broad, sometimes slightly emarginate.

2. C. SUFFRUTICOSA (Torr.) Wats. Bot. Calif. **2:** 43. 1880.
Alternanthera suffruticosa Torr. Bot. Bound. 181. 1859.

This species has a thick shrubby base and specimens show branches of the preceding year among the flowering shoots.—Reported only from western Texas (*Wright* 1757 and 592; *Harvard* 110 in 1883). Wright's specimens are in herb. Gray, Columbia College and Nat. herb.

+ + Staminodia longer, acute (nearly one-half the length of the filament).

3. C. OBLONGIFOLIA Wats. Proc. Amer. Acad. **17:** 376. 1882.
C. cryptantha Wats. l. c. **26:** 125. 1891.

Stems procumbent, often 6[dm] long, suffruticose or shrubby ("sometimes showing several years' growth at the base," Coville: Bot. Death Valley 179), the whole plant covered with a very dense persistent white stellate pubescence: branches short, ascending or erect, much crowded: leaves ovate-oblong or oblanceolate to round spatulate, or sometimes minute, elliptical, densely aggregated: flowers in small axillary clusters, deeply imbedded in tomentum, the reduced upper leaves of the flowering branches often forming a sort of involucre: sepals hyaline, white: staminodia present in the form of acute lobes between the filaments, and scarcely less than half their length.—Confined to south-eastern Arizona and the adjoining regions of California. Types of the Newberry collection in herb. Gray, and Nat. herb.; of Pringle in herb. Gray, Coulter, J. D. Smith, and Nat. herb.; of Parish brothers in the same herbaria.

It will be noticed that the forms merged under this species fall together very naturally by virtue of their limited range, suffruticose habit and somewhat prominent intermediate lobes of the stamineal tube (staminodia), though *C. oblongifolia* thereby loses its character of exclusively oblong leaves.

Herbarium Lake Forest University.

Notes from my herbarium. III.

WALTER DEANE.

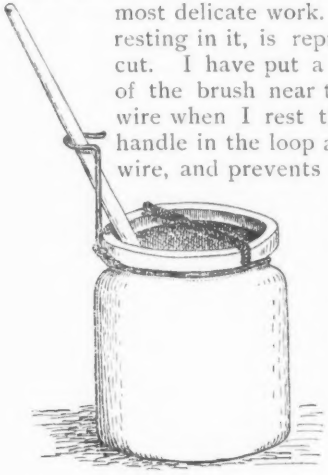
How I mount plants.

Plants should be mounted for the herbarium with as much care as they are collected and pressed. The æsthetic side should keep pace with the practical side of utility, and this can be done just as easily as not. It takes no more time to mount a plant well than to do it poorly. The suggestions I offer are the result of fourteen years of experience, during which I have constantly tried to do my work better and easier. They apply to the mounting of phanerogams and the pteridophytes.

I do all my work sitting at my table, pasting, mounting the plants and labels, putting the sheets under a weight from time to time, etc., without rising from my seat. In this way I frequently mount from fifty to sixty sheets in an evening, many of the plants being delicate grasses and the like. On a few occasions I have mounted as many as one hundred sheets. Everything must be carefully systematized. Close to my table on the left, within easy reach of my hand, is my mounting-box resting on a chair, with the hinged front of the box dropped down. This box is full, or partly so, of sheets with the plants, labels, paper-pockets and so on, lying on each sheet, as they are to be mounted. All this work of arranging has been previously done, after the plants have been poisoned, labelled, etc. The inner dimensions of a mounting-box should be a little larger than those of a mounting sheet, in order that the sheets may be easily put in and withdrawn from the box.

Directly in front of me, on the left hand side of the table, is a board on which my mounting is done. On this I lay a couple of driers such as I use to press plants. The space directly to the right of this is devoted to the pasting of the plant. For this purpose I use sheets of a rather thin blotting paper, no smaller than a mounting sheet in size. I lay one of these sheets on the table, and I generally lay under it two or three sheets of the white paper I use in drying plants. To the right of this is my glue-pot and brush, a pair of forceps with which to pick up the smaller

plants for pasting, and a bit of stiff cardboard a foot in length and one-half an inch or so in width. I also have close by a small paper box divided into compartments and filled with slips of gummed paper of various sizes. My glue-pot, for suggestions in regard to which I am indebted to Mr. M. S. Bebb, is a marmalade jar, about which I have twisted a piece of stiff wire, raising the end some two inches above the edge, and making a loop at the end against which to lean the brush when it is not in use. I have also stretched a bit of wire across the top to take off some of the glue when there is too much on the brush. The brush is a common pasting-brush, about an inch wide at the bottom, and thin. This will do the most delicate work. The glue-pot, with the brush resting in it, is represented in the accompanying cut. I have put a tack half way in, on the handle of the brush near the top. This catches on the wire when I rest the brush on the pot, with the handle in the loop and the bristles on the cross-wire, and prevents the brush from slipping. As I rest the brush in this way every few seconds when mounting, this is of great service.



To the right of my chair on a small rest is a good pile of driers. To the left of my chair, out of the way of the mounting-box, is a rest on which is a board to receive the mounted plants, as will be explained hereafter. I also have ready on the table a piece of rather stiff white paper, some five by three inches, to use when putting on the labels. From my bottle or jar of fish-glue I pour half an inch or less into the glue-pot, and then add water, stirring it up with my brush, till it is of the right consistency. I want the glue to drip off the brush when I lift it up, but not too freely. Experience is the best guide. Now I don my apron, so that I can wipe my fingers on it at any moment, draw my chair up to the table, and I am ready for work.

I lift the top sheet from the box, and lay it on the driers before me. We will imagine the plant a stiff one which can be readily lifted up. First, I take up the label and lay it face down on the blotting-paper. I put one finger on the

middle of it, and paste the four edges of the label, making as thin a margin of glue as I can conveniently do. Then I lay the brush back on the glue-pot, take up the label, and lay it on the corner of the sheet in position. I press it gently down, take the bit of white paper in hand, lay it over the label, and rub hard. The whole operation takes a comparatively few seconds, the label is in position, it is not soiled by rubbing the fingers over it, while the small amount of glue on ths edges of the label keeps the corner of the sheet from curling in the slightest degree. When the label is glued all over, the sheet curls. This method I learned some years ago from Mr. M. S. Bebb, and I most heartily endorse it.

Then I lift up the plant, reverse it, lay it on the blotting-paper, and paste it over, not too thickly, getting as little glue as possible on the blotting paper. Then I lay the plant back in position on the mounting sheet, lay over it a couple of driers from my pile on the right, and rub the hand over it a little to press the plant down. I paste on the pockets either before or after doing the plant. If the plant has a thick stem or large fruit, I lay on more than two driers, enough to make a smooth surface for the next sheet. Then I take out another sheet from the mounting box and repeat the operation. When the plant is laid on the blotting paper to be pasted, it will be found that what glue may have got on to it in pasting the previous plant has been absorbed into the sheet, so that one lays the plant on a dry sheet, instead of on a gluey one, thereby getting glue on the upper surface of the plant. Almost all herbaria show dried glue on the plants and sheets. The plants have doubtless been pasted on pieces of newspaper, or some other kind of paper which is non-absorbent, and so the glue which remains on the paper soils the plants, unless the paper is changed for almost every plant. With a little care I can easily make a single sheet of blotting paper last for at least one hundred mounts, before throwing it away, for of course in time the sheet will become filled with the absorbed glue. If a drop of glue stands on the sheet without being absorbed, as sometimes happens, I take it up with my finger, rub my finger on my apron, and go on. I reverse the sheet of blotting paper every few minutes.

Now we come to a plant too flimsy to be lifted. Such we constantly meet with. It takes but a few seconds longer to mount it. After pasting the labels, and pockets if there are any, on the mounting sheet, I take up the blotting paper and reverse it on the sheet, making one corner and edge of the

two sheets match exactly, and then on this I lay a couple of driers. I take up the sheet with one drier under it and the two on top, and holding these in my left hand, I put my right hand on the middle of the pile and reverse it, laying the whole down again. I lift up carefully the single drier and mounting sheet, and I have the plant on the blotting paper, undisturbed, and ready to be pasted. In putting the glue on a flimsy plant, and often on a stiff one of any size, I take my strip of cardboard previously mentioned, lay it across the plant near the top, and then, with one hand on it, paste the part of the plant above it. This holds the plant well in position while I am pasting. Then I either paste the part below, or move the cardboard lower down to suit my convenience. After pasting the plant, I lay the mounting sheet on it, matching the same edges and corners as before, put the drier on top and reverse the whole. I carefully lift up the two driers and the blotting paper from the mounting sheet, and the plant is mounted in exactly the original position. This takes far less time to do than to describe. I then put the two driers on the sheet and proceed as usual.

When I have mounted a dozen sheets, more or less, according to the time taken, I take the whole pile from the board and transfer it to the board on the left, laying on the pile, as a mark, a piece of paper projecting over the edge, and then on this I lay a pile of driers, six inches or more in thickness as a weight. This is very necessary. It ensures a smooth plant and sheet when the glue is dry. There is no danger of the drier sticking to the sheet if the work is properly done. Should this happen, it is a sign of careless work, and the appearance of the sheet is injured. Every time I put a fresh pile of mounted sheets in the press, I take off the driers used for a weight, lay them in my lap till I have laid the pile on, and then replace them. If I am mounting in the evening I can take the sheets out of the press the next morning. I use the gummed strips on those parts of plants which the glue does not hold. I generally put them on after the sheets are removed from the press. For an herbarium that is to be used very much, I do not believe in putting the plants on the sheets with gummed strips alone, as the plants break much more easily when handled.

Long experience convinces me that the methods described above are the best. The object is to mount plants neatly and as rapidly as possible, and I cannot but feel that this method produces both results.

Cambridge, Mass.

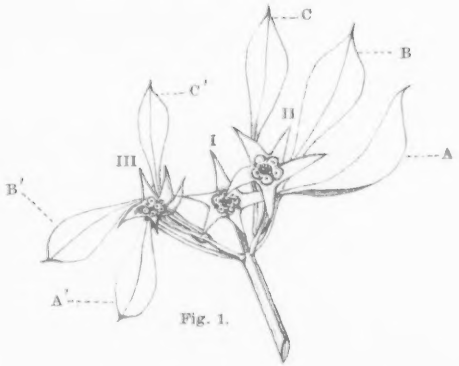


Fig. 1.

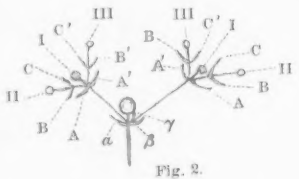


Fig. 2.

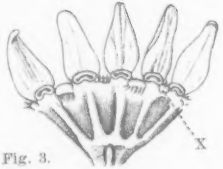


Fig. 3.

Fig. 4.

Fig. 4.

Fig. 6.

Fig. 7.

Fig. 8.

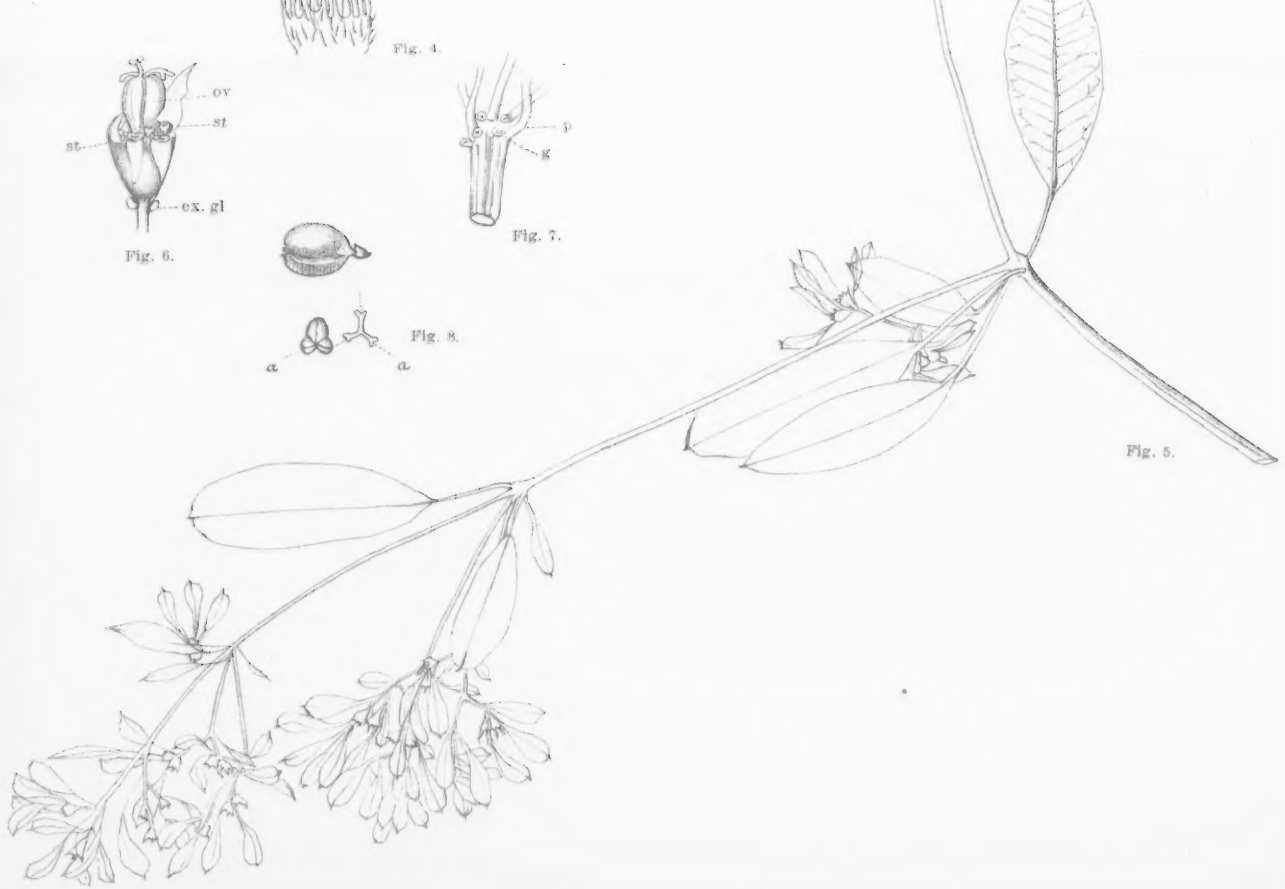


Fig. 5.

J. P. LOTSY, DEL.

EUPHORBIA LEUCOCEPHALA. nov. spec.

A Hoen & Co Lith Baltimore

Fig. 7.

Fig. 8.

Fig. 8.

♀ Bud.

P

Fig. 9.

Fig. 10.

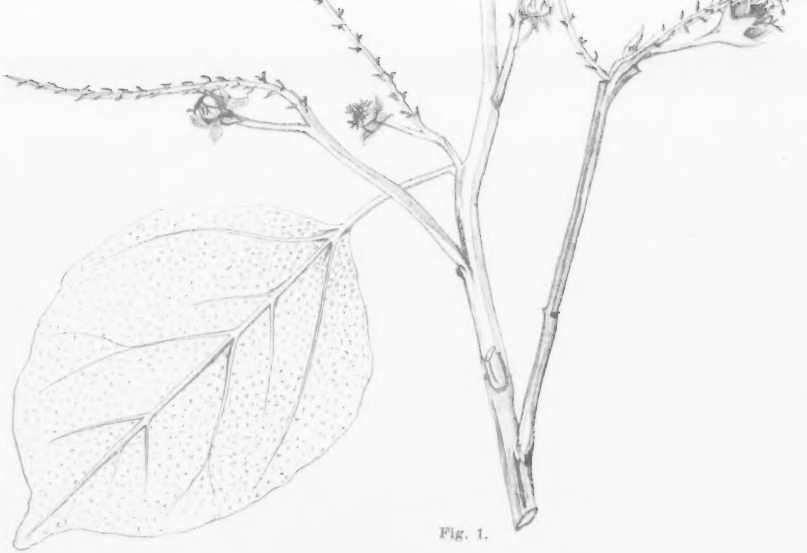


Fig. 1.

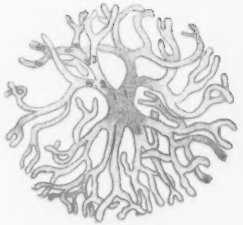
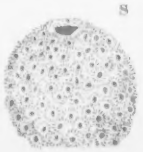


Fig. 2.

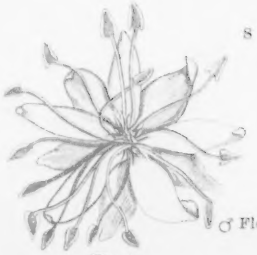
Fig. 3.

J. P. LOTSY, DEL.



S

Fig. 4.



S

P

♂ Flower.

Fig. 5.

S

P

Perianth of ♀ Flower.

Fig. 6.

CROTON ELUTERIOIDES nov. spec. et CROTON GUATEMALENSIS nov. spec.

Some Euphorbiaceæ from Guatemala.

JOHN P. LOTSY.

WITH PLATES XXIV AND XXV.

At the request of Capt. John Donnell Smith I undertook the determination of his last acquired Euphorbiaceæ. After classification the specimens were compared by me with those in the Ryksherbarium[1] of the University of Leiden, Holland, and in the National Herbarium at Washington, D. C.

Euphorbia rubrosperma, n. sp. (§ ANISOPHYLLI, Chamysyceæ Leiospermæ DC. Prod. **15**[2]: 27.)—Tota crispule hirta, caulibus filiformibus carnulosis ad articulationes incrassatis e basi ramulosis. Folia basi valde inaequalia ovata orbiculata irregulariter dentata acuta vel obtusa, stipulis interpetiolaribus lanceolatis ciliatis basi minutissime bidentatis. Cyathia in axillis supremis cymulosa, involucris minutis campanulatis extus hirsutis intus glabris, lobis angustis extus ad margines ciliolatis. Glandulæ 4 exappendiculatæ cyathiformes longiter stipitatæ. Ovarium hirtum, stilis 3 bipartitis non incrassatis sub lente punctulatis trigonis rubellis.

Santa Rosa, Depart. Santa Rosa, alt. 3,000ft, Dec. 1892, Heyde & Lux, no. 4,271.

A small creeping plant with a firm primary root. The plant when dry has small green leaves, here and there becoming red, as do also the involucres of the inflorescences. Length of one of the creeping branches, 5–6cm. Length of leaves 0.5cm. Length of seed 0.06cm.

EUPHORBIA XALAPENSIS HBK. (§ CYTTAROSPERMI DC. Prod. **15**[2]: 53).

San Raphael, Depart. Zacatepéquez, alt. 6,500ft, Febr. 1892, John Donnell Smith, no. 2,617.—San Miguel, Dept. Quiché, alt. 6,000ft, April 1892, Heyde & Lux, no. 3,479.—Laguna di Ayarza, Dept. Jalapa, alt. 8,000ft, Sept. 1892, Heyde & Lux, no. 3,849.—Volcan Jumaytepeque, Dept. Santa Rosa, 6,000ft, Dec. 1892, Heyde & Lux, no. 4,269.

Euphorbia microappendiculata, n. sp. (§ CYTTAROSPERMI.)—Caulis cum ramis oppositis glabris sed ad articulationes

[1] To the subdirector of this herbarium, Dr. J. G. Boerlage, I am indebted for much valuable aid and advice.

pauciter pubescentibus fistulosus ad folia adpresse pubescens. Folia integra, inferiora sparsa, superiora opposita vel ternata; inferiora petiolata ovata acutiuscula, superiora lanceolata, glandulis stipularibus obsoletis. Cymæ terminales vel axillares longiter pedunculatæ 3-cephalæ, involucris longiuscule pedicellatis campanulatis hemisphaericis adpresse pubescentibus, lobis triangularibus pauciter fimbriatis. Glandulæ 4 ovatæ valvatæ, appendicibus rotundatis apice obscure cordatis concaviter inclusis. Stili bipartiti. Capsula ignota. Semen ignotum.

A plant two to three feet high. Leaves pinnately veined with seven to ten pair of secondary veins, covered with scattered hairs on upper side, densely covered on lower side with a grey felt, glabrous on the veins. Bracts of inflorescence spatulate, about one-half longer than the cyathia. Length of blade 5^{cm}. Width of blade at broadest place 2.5^{cm}. Length of petiole $1-1.3^{cm}$.

Laguna de Ayarza, Depart. Jalapa, alt. $8,000^{ft}$, Sept. 1892, Heyde & Lux, no. 3,850.

EUPHORBIA OCYMOIDEA L. (§ CYTTAROSPERMI.)

Rinconcito, Depart. Santa Rosa, alt. $4,000^{ft}$, Nov. 1892, Heyde & Lux, no. 4,263.

EUPHORBIA ARENARIA HBK. (§ CYTTAROSPERMI.)

Ojo de Agua, Depart. Santa Rosa, alt. $3,500^{ft}$, Dec. 1892, Heyde & Lux, no. 4,262.

EUPHORBIA LANCIFOLIA Schlecht. (§ DICHILII DC. Prod. **15**^{2}: 59.)

Rinconcito, Depart. Santa Rosa, alt. $4,000^{ft}$, Nov. 1892, Heyde & Lux, no. 4,264.—Naranjo, Depart. Santa Rosa, alt. $3,500^{ft}$, May 1892, Heyde & Lux, no. 4,581.

Euphorbia leucocephala, n. sp. (§ ALECTOROCTONI DC. Prod. **15**^{2}: 59.)—Frutex glabra juventute lanosa, ramis striatis ad articulationes incrassatis. Folia inferiora verticillata, caetera plerumque ternata vel rarius verticillata; folia longe petiolata, inferiora obovata, superiora oblonga apice mucronata. Dichasia terminalia polycephala. Bractea alba spathulata mucronata involucris triplo vel quadruplo longiora. Cyathia basi externe biglandulata, involucris breve pedicillatis campanulatis hirtis, lobis transverse oblongis ciliatis. Glandulæ quinæ transverse oblongæ, appendicibus integerrimis eis 6-plo longioribus. Stili bipartiti. Capsula glabra profunde trisulcata. Semen ecarunculatum.

Shannon's note says, "a shrub, rather a vinelike shrub. I believe is a vine that grows generally near another (plant) and overtops the companions. Plant 60^{cm}–2.1^{m} high."

Leaves pinnately veined, veins fourteen to sixteen, covered with extremely few hairs on both sides, rather more along the midrib. Some of the leaves turning red, at least in herbarium specimens. Inflorescence remarkable for its numerous white bracts, which has suggested the specific name of *leucocephala*. Very few of the cyathia have female flowers. Dried styles persistent on top of capsule. Seeds, not entirely ripe, with a dried funiculus, which suggests sometimes a small shriveled carunculus. Blade of lower leaves 6–8^{cm} long, at broadest place about 3.5^{cm} wide. Petiole 2–2.5^{cm} long. Ternate leaves 3–4^{cm} long, at broadest place 1.5–2^{cm} wide. Bracts 1–1.5^{cm} long. Capsule about 0.5^{cm} long and equally broad.

Cuilco, Depart. Huehuetenango, alt. 3,800^{ft}, Dec. 1891, Shannon, No. 305.—Volcan Chingo, Depart. Jutiapa, alt. 4,000^{ft}, Oct. 1892, Heyde & Lux, no. 3,661.—Rio Negro, Depart. Quiché, alt. 3,600^{ft}, Mar. 1892, Heyde & Lux, no. 3,482.—Patzicia, Depart. Chimaltenango, alt. 6,500^{ft}, Febr. 1893, Heyde & Lux, no. 6,377.—PLATE XXIV.

EUPHORBIA DENTATA Michx. (§ POINSETTIÆ DC. Prod. **15**^{2}: 71.)

Las Cañas, Depart. Santa Rosa, Nov. 1892, alt. 3,000^{ft}, Heyde & Lux, no. 3,837.

Euphorbia chamaepeploides, n. sp. (§ TITHYMALI sub-sect. *Esulæ* DC. Prod. **15**^{2}: 138.)—Glabra a collo ramosa, caulibus adscendentibus vel erectis, umbellæ radiis tribus. Folia obovata integerrima basi in petiolum attenuata; folia floralia ovata basi obscure cordata sessilia opposita vel ternata. Involucra turbinata, lobis triangularibus margine ciliatis. Glandularum cornua glandulæ latitudini aequilonga. Stili breves bifidi. Capsula glabra profunde trisulcata. Semen ad facies binas internas longitudinaliter sulcatum ad 4 exteriores linea 3–5 fovearum rotundarum exsculptum sub lente totum punctulatum. Caruncula conica.

A very near relative of *Euphorbia chamaepeplus* Boiss. & Gail., perhaps only a variety of it. Only one individual seen. Height of plant 17^{cm}, length of blade 0.6^{cm}, width of blade at broadest place 0.5^{cm}, length of peduncle 0.15^{cm}, length of upper sessile leaves 0.8^{cm}, length of capsule 0.15^{cm}, length of seed 0.1^{cm}.

San Martín, Jilotepeque, Depart. Chimaltenango, alt. 6,000ft, Mar. 1892, Heyde & Lux, no. 3,481.

EUPHORBIA CAMPESTRIS Cham. & Schlecht. (§ POINSETTIÆ.)

Cunén, Depart. Quiché, alt. 6,000ft, April 1892, Heyde & Lux, no. 3,467.

PHYLLANTHUS NIRURI L. (§ EUPHYLLANTHI DC. Prod. **15**^{2}: 374.)

Volcan Jumaytepeque, Depart. Santa Rosa, 6,000ft, Dec. 1892, Heyde & Lux, no. 4,270.

CROTON ELUTERIA Benn. (§ ELUTERIÆ DC. Prod. **15**^{2}: 514.)

Palin, Depart. Amatitlan, alt. 3,560ft, Feb. 1892, John Donnell Smith, no. 2,616.

Croton eluterioides, n. sp. (§ ELUTERIÆ).—Planta in tota parte juvenili lepidota. Folia penninervia utraque pagina lepidota, limbo ovato integerrimo apice breviter acuminato basi rotundato eglanduloso, petiolo quam limbus 2–14-plo breviori, stipulis triangularibus lepidotis. Racemi axillares foliis multobreviores densiflori basi feminini apice masculini. Calycis lacinia utriusque sexus ovata acuta lepidota. Petala utriusque sexus late ovata non lepidota pilosa. Stamina circa 15, filamentis sparse barbatis. Ovarium 2-merum lepidotum. Stili 3 bipartiti, laciniis repetite bifidis.

Differs from *Croton Eluteria* in the number of stamens, the more repeatedly branched style, the much broader and larger leaves which are shortly in place of longly acuminated.

A bush about 12ft high. Leaves when young covered on both sides with silvery scales; these gradually disappear from the upper surface almost entirely, while the lower surface contains on old leaves so few scales that in herbarium specimens, owing to the brown color of the leaf, these appear at first sight rusty-lepidote instead of silvery-lepidote. As far as the specimens at hand go, the number of female flowers seems to vary between one and two at the base. The number of male flowers also is limited. Ripe capsule unknown. Length of blade 10cm, width of blade at broadest place 0.45cm, length of petiole 0.5cm, length of largest capsule found 0.21cm, width of largest capsule found 0.15cm.

Santa Rosa, Depart. Santa Rosa, alt. 3,000ft, June 1892, Heyde & Lux, no. 3,470. —PLATE XXV.

Croton Guatemalensis, n. sp. (§ ELUTERIÆ).—Planta in tota parte juvenili lepidota. Folia penninervia utraque pagina lepidota, limbo ovato integerrimo apice breviter acuminato basi rotundato eglanduloso, petiolo quam limbus 3–4 plo breviori, stipulis obsoletis. Racemi graciliter spicaeformes foliis multo longiores densiflori basi feminini apice masculini. Calycis lacinia utriusque sexus ovata acuta lepidota. Petala utriusque sexus ovato-lanceolata non lepidota margine barbata. Stamina circa 15, filamentis glabris. Ovarium 2–3-merum lepidotum. Stili 3-partiti, laciniis repetite bifidis.

Tree 20–25^{ft} high. Flowering branches of very graceful aspect. Leaves when young covered on both sides with silvery scales; these gradually disappear from upper side so that the older leaves of herbarium specimens appear brown above and silvery beneath, a considerable number of scales remaining however on upper surface. As far as the specimens at hand go, every inflorescence seems to have a solitary female flower with a long peduncle at its base. As is seen from the plate, the male flowers drop pretty early and long before the capsule is ripe, but this may be partly due to the drying. In the female flower a ring-wall can be seen with five episepal bifid glands. The male flower is densely clothed with hairs on the receptacle. Ripe capsule unknown. Seeds (not entirely ripe) smooth.

Santa Rosa, Depart. Santa Rosa, alt. 4,000^{ft}, May 1892, Heyde & Lux, no. 3,035.—PLATE XXV.

JULOCROTON TRIQUETER Baill.

Cerro Gordo, Depart. Santa Rosa, alt. 3,500^{ft}, August 1892, Heyde & Lux, no. 3,838.

ACALYPHA SCHLECTENDAHLIANA Müll. Arg. (§ EUACALYPHÆ DC. Prod. **15**^{2}: 803.)

Barranca de Eminenzia, Depart. Amatitlan, alt. 1,400^{ft}, Feb. 1892, John Donnell Smith, no. 2,618.

ACALYPHA CANCANA Müll. Arg. (§ EUACALYPHÆ.)

Rio de Los Esclavos, Depart. Santa Rosa, alt. 2,500^{ft}, Feb. 1893, Heyde & Lux, no. 4,580.

ACALYPHA MACROSTACHYA Jacq., var. SIDÆFOLIA Müll. Arg. (§ EUACALYPHÆ.)

Pansamalá, Alta Vera Paz, alt. 3,800^{ft}, Oct. 1888, von Türckheim, no. 1,417.

TRAGIA VOLUBILIS Müll. Arg. (§ EUTRAGIÆ DC. Prod. **15**^{2}: 932.)

Estanzuela, Depart. Santa Rosa, alt. 2,500^{ft}, Aug. 1892, Heyde & Lux, no. 3,846.

Tragia Guatemalensis n. sp. (§ EUTRAGIÆ.)—Frutex scandens pube brevi et pilis urentibus dense obsita. Petiolus limbo foliorum 2–4-plo brevior, limbo basi palmatinervio et cordato apice breviter acuminato. Racemi longe pedunculati non bipartiti basi flores duos femininos apice flores plures masculinos gerentes. Bractea feminina aequaliter tripartita; bractea masculina tripartita, lobo medio longiore. Pedicellum masculinum articulatum, parte persistente bractea longiore.

Calycis femininæ lacinia 6 lanceolata, calycis masculinæ lacinia 3. Stamina 3.

Leaf palmatinerved at the base with about five veins, the middle one strongest forming the midrib of the leaf. Secondary veins pinnate, three to four pairs. Inflorescence about the length of the petiole. The two female flowers have such long peduncles that they reach about as high as the top of the male part of the inflorescence. Fruit densely covered with bristly hairs. Seeds globular, pale yellow with brown irregular dots. Length of limb of leaf 0.73^{cm}. Width of limb of leaf at broadest place 0.3^{cm}. Length of petiole 0.18^{cm}. Diameter of fruit 0.1^{cm}. Diameter of seed 0.4^{cm}.

Chicacao, Depart. Alta Verapaz, alt. 3,500^{ft}, April 1889, J. Donnell Smith, no. 1,763.

JATROPHA CURCAS L. (§ CURCAS DC. Prod. **15**^{2}: 1,076.)

Santa Rosa, Depart. Santa Rosa, alt. 3,000^{ft}, May 1893, Heyde & Lux, no. 4,582.

HURA CREPITANS Müll. Arg.

Sacapulas, Depart. Quiché, alt. 3,800^{ft}, April 1892, Heyde & Lux, no. 2,901.

Johns Hopkins University.

EXPLANATION OF PLATES XXIV AND XXV.

PLATE XXIV. *Euphorbia leucocephala.*

Fig. 1. Dichasium, the length of the lateral cyathia exaggerated to make relations plainer.—Fig. 2. Diagram of dichasium.—Fig. 3. Involucre from inside, showing lobes, *x*, and appendiculate glands.—

Fig. 4. Enlarged fimbriated lobe of involucre.—Fig. 5. Flowering branch, natural size.—Fig. 6. Cyathium with one female, *ov*, and several male flowers, *st*, showing extracyathial glands, *ex. gl.*—Fig. 7. Node; only the petioles of the leaves drawn, showing stipulate glands. —Fig. 8. Capsule showing position of styles.

Plate XXV.

Figs. 1–6, *Croton Guatemalensis.*

Fig. 1. Flowering branch, natural size.—Fig. 2. Styles, enlarged.—Fig. 3. Ovary in longitudinal section, enlarged.—Fig. 4. Ovary enlarged; *s*, indicates the place where the styles were inserted.—Fig. 5. Male flower, enlarged; *S*, sepals, *P*, petals.—Fig. 6. Female flower after removal of ovary, enlarged; *S*, sepals; *P*, petals..

Figs. 7–10, *Croton eleuterioides.*

Fig. 7. Young inflorescence natural size.—Fig. 8. Female flower in bud enlarged; *P*, petal, *S*, sepal.—Fig. 9. Petal from female bud.—Fig. 10. One style, the two others cut off.

Vegetal dissemination in the genus Opuntia.

J. W. TOUMEY.

The discussion here presented is based upon observations made during the past four years on the various species of Opuntia indigenous to Arizona. All of these plants, more especially the younger growth, are soft and fleshy, with large quantities of sap stored in the cortex and pith. No other plants so persistently retain their moisture when once secured. A thick epidermis with small sunken stomata and the evaporating surface brought down to a minimum, by the condensed form characteristic of the entire genus, enable them to remain green for months, even when continually exposed to the dry and scorching heat of our southwestern plains. They are alike at home on the plains and among the rocks of our mountains and foot-hills. Although of recent origin, compared with other large families of plants, they have lived for ages subjected to an environment which has placed them among the greatest economizers of water to be found in the entire vegetable kingdom. Not only are they economizers of water, but their tissues are, under ordinary circumstances, well provided with water, even after months of exposure to an average maximum temperature of 100° F. and untouched by dews or rains.

Much of the tissue entering into their composition, consists of large thin-walled parenchyma cells, which serve as store-houses of water. These cells have the power of taking up water with great avidity after and during a rain, or when the ground is moist, and as a result the young branches become plump, smooth, thicker, and the tubercles less prominent. As the days become warmer and the rains less frequent these cells gradually give up their contained moisture and the joints become withered and wrinkled. This process is, however, very slow, as many species remain green a year or even longer, after every source of outside moisture has been withdrawn.

The first of July, 1892, half of one of the flat joints of *Opuntia basilaris* was brought to my room and placed, without soil or moisture, in a small open box. The specimen was

three inches long, two inches wide and from one-half to two-thirds of an inch in thickness. On the tenth of the same month I observed a branch developing at one of the upper tubercles.

The specimen began to attract my attention and on weighing it I found it weighed 11.78^{gm}. The ten days intervening from the time the specimen was procured until it was weighed it undoubtedly lost considerable by evaporation. In the meantime, however, the large wound, caused by cutting the joint lengthwise had become practically impervious to evaporation by the exuding of the mucilaginous substance of the adjacent cells forming a thick scab-like crust over the wound.

The branch continued to grow rapidly while the old stem began to wither at the point farthest away from the branch. This process continued much in the same manner, month after month, during the entire summer. Not a single drop of moisture came in contact with it after it was placed in the box.

On the twentieth of January of the following year the specimen weighed 10.016^{gm}, losing in six months a little over fifteen per cent. of its total weight. At this time the branch had grown to be five and one-fourth inches long, or nearly twice the length of the old joint. It was, however, very slender and thin.

About seven-eighths of the old stem was dry and hard, but the portion immediately surrounding the base of the growing stem was as fresh and green as ever.

The next observation was on April fourth. At this time the specimen weighed 9.259^{gm}. The old stem was now entirely dry; the branch was nearly six inches long and as fresh as ever. By the middle of May the branch began to wither, but a new one had begun to develop about an inch from the apex of the other. By June twentieth, the new branch had grown to be two inches in length but was even now more slender than the first. In the six months from January to June, inclusive, the specimen had lost a little less than eight per cent. of its weight at the time of the first weighing. No further observations were made for a period of four months. On my return from the east in September the entire plant was dry.

The persistency with which cylindropuntias retain their

moisture is as marked as it is in the flat-stemmed forms. In October, 1893, a number of one-year-old stems of *Opuntia Bigelovii* were placed in an open box to dry. Eleven months later these specimens were somewhat shrivelled but on being cut open were found to contain considerable moisture. Of the twenty or more joints placed in the box, none developed branches, but each grew a number of roots, usually one from each of a score or more of tubercles at the base of the joint. Many of these roots were four inches long and remained green throughout the summer.

In December, 1893, a number of nearly mature fruits of *Opuntia fulgida* were collected and similarly placed in an open box. At the end of ten months they had all developed long roots from the small tubercles at the base of the fruit but were practically nearly as green as ever.

The persistency with which these plants retain their moisture makes vegetal dissemination possible. With many species it is not necessary that the detached joints be disseminated during the rainy season. If they chance to fall to the ground during the driest portion of the year their contained moisture is sufficient to enable them to put forth roots which soon firmly anchor them to the ground, and a new plant is the result.

The opuntias of Arizona belong to the two sub-genera, Platopuntia and Cylindropuntia. With few exceptions the former are, in habit of growth, prostrate or at most only semi-erect, while the latter are nearly all erect. Both agree in having bristles and usually spines, which in many species are numerous and highly developed. The bristles are always barbed and are usually more numerous and more highly developed in Platopuntia. The spines in the two sub-genera differ in that in Platopuntia they are but slightly barbed, while in Cylindropuntia the barbed character of the spines is very pronounced. Morphologically the bristles and spines are the same; little is known, however, in regard to their functions.

As pointed out by Dr. W. F. Ganong,[1] it has been frequently asserted that the function of the spines is largely for protection and that the readily detached and irritable bristles serve the same purpose. There is no question but

[1] Present problems in anatomy, morphology and biology of the Cactaceæ. BOTANICAL GAZETTE **20:** 129. 1895.

the spines do serve largely to protect these succulent plants from the ravages of animals. If they were not so protected, in a few years they would entirely disappear from our western plains. Another important function, more especially in Cylindropuntia, is their great aid in dissemination.

It is not sufficient that the joints grow when detached from the parent plant. They must find a means of transportation from one place to another. In cylindropuntias this is largely effected by means of the barbed spines which adhere closely to all objects which come in contact with them.

As previously stated the spines of Platopuntia are nearly smooth or but slightly barbed, but with these plants barbed spines are not necessary to effect transportation; they are disseminated in an entirely different manner.

The species of Platopuntia being mostly prostrate or semi-prostrate, spread out with growth, forming large oval or circular patches. The branches creeping or bending to the ground take root at each joint. In the course of time, the original plant dying, the several branches become independent plants. This process is repeated until the product of a single plant may extend over a large area. Among specimens of *Opuntia phæacantha* growing a few miles east of Tucson I have traced nearly twenty plants to a common center, some of them being several rods distant. As a rule a dozen or more plants, in the immediate vicinity, indicate that they are the product of a single plant. Usually it is not difficult to locate the position of the original plant long after every vestige of it has disappeared. I am convinced that nearly all of our flat-stemmed opuntias are disseminated in this manner. It does not apply of course to the few upright forms like *Opuntia chlorotica.* Although these upright forms are not disseminated in the same way as the prostrate plants, vegetal dissemination is not entirely eliminated. The young joints of the upright species are much more easily detached than in the prostrate species. Cattle and other animals feed to some extent upon them. From one cause or another many of the joints are broken off. The spines, although but slightly barbed, are of some aid in dissemination. They raise the detached stems from the ground so that they are more easily disturbed by animals or other moving objects coming in contact with them and they are scattered further from the parent plant than they would be if devoid of spines.

In a recent observation on *Opuntia chlorotica* growing at Steins Pass, N. M., detached joints were found, at least two rods from the plant upon which they grew. They were all firmly anchored by long roots penetrating the ground from under side of the joint.

It is with the cylindrical opuntias, however, that the spines have an important part to play in vegetal dissemination. Nearly all of this large group depend almost entirely for dissemination upon the readiness with which the terminal branches break off and upon the highly developed barbed spines which cover them.

One of the species best adapted for dissemination is *Opuntia Bigelovii*, a plant abundant on the mountains and foot-hills of south-central Arizona. The tubercles are crowded and the pulvilli are covered with numerous, radiating, highly barbed spines. These formidable spines are so numerous that they completely hide the epidermis of the plant. Although the joints are from two to five inches long and more than an inch in diameter, the point of union with the old stem is very slight, the scar left at the place of detachment being but two or three lines in diameter. The slightest touch will detach the young joints and they cling as formidable burrs to any object with which they come in contact. It is not an unusual sight on the Arizona plains, to see cattle with scores of these burrs firmly fastened to their legs and head. They are sometimes carried for miles and when finally detached, even after weeks of travel, are in condition to grow. This plant depends so completely upon this method of dissemination that it has almost entirely lost the power of seed-production. In fifty fruits examined last fall, but two perfect seeds were found. Forty-eight of the fruits were sterile and the other two had but one perfect seed in each.

Of the fourteen species of Cylindropuntia which I have examined in the field, all are more or less adapted for dissemination in this manner. Some species, such as *Opuntia Bigelovii*, *O. fulgida*, *O. mamillata*, *O. echinocarpa* and *O. prolifera*, are exceptionally well adapted for this method of dissemination; the joints are easily detached and are well armed with strong barbed spines.

The fruits of the larger number of the above species are seldom sterile but the seeds are small, and in our unfavorable climate, seldom germinate. Among the thousands of speci-

mens of Opuntia Bigelovii and Opuntia fulgida that have come under my observation, I have never as yet seen a single seedling developed under natural conditions. The ground in the vicinity is strewn with numerous detached joints, all capable of becoming new plants.

In some of the smaller species, as *Opuntia leptocaulis*, *O. tessellata*, and *O. arbuscula*, numerous short, lateral joints are developed; which, although small, retain their moisture for a long time after being detached. Evidently the function of these small, easily detached joints, is for vegetal dissemination. The fruits of two of these plants, viz. O. tessellata and O. arbuscula, are usually sterile.

Opuntia arborescens, *O. Whipplei*, *O. versicolor* and similar species are not so well adapted for this method of dissemination. With these plants the joints are not readily detached and the spines are not so strongly barbed; they depend to a much greater extent upon seed dissemination, as is illustrated in the fact that it is not an unusual thing to find seedlings of these plants in all stages of development.

As a generalization it may be stated that with this great group of plants the adaptations for vegetal dissemination are inversely as their seed production.

University of Arizona, Tucson.

A study of some anatomical characters of North American Gramineæ. V.

THEO. HOLM.

WITH PLATE XXVI.

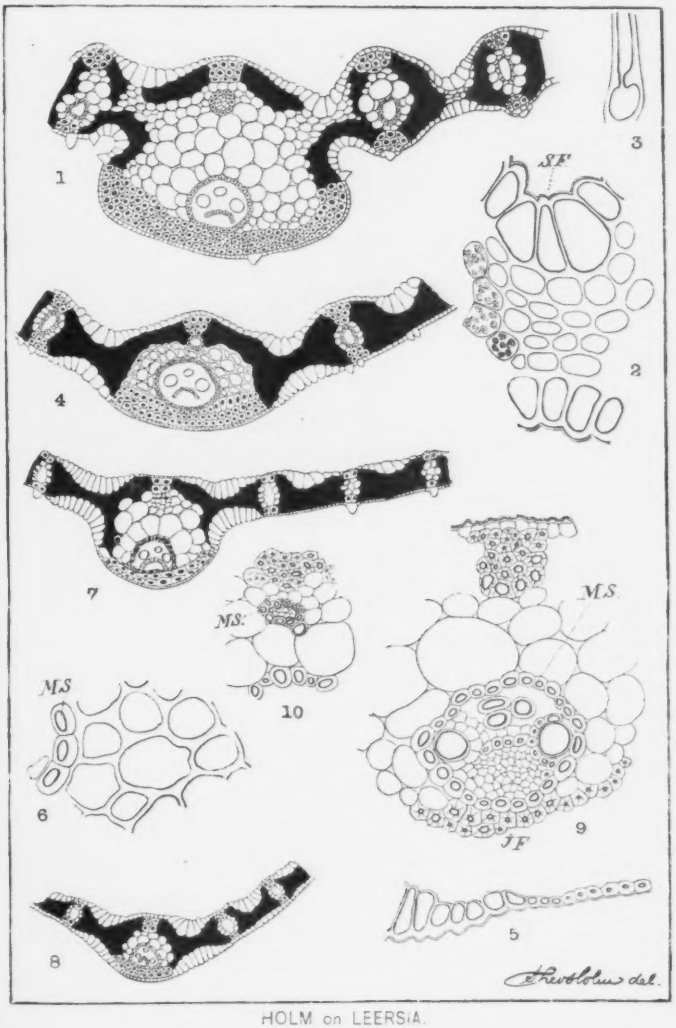
The genus Leersia.

In a previously published paper[1] we have described the leaf-structure of Leersia oryzoides, and we will now consider the other species of this genus, *L. lenticularis* Michx., *L. Virginica* Willd., *L. monandra* Swtz., and *L. hexandra* Swtz.

The anatomical structure of the leaf appears to be very uniform in this genus, and transverse sections of the midrib and the surrounding tissues show very few differences from what we have already mentioned for L. oryzoides. This uniformity in structure is undoubtedly due to the fact that the species in question inhabit the same kind of localities, viz., borders of lakes, ponds, or swamps. Leersia hexandra, however, very often grows in deep water, and therefore this species shows a greater development of the bulliform cells and the colorless parenchyma than any of the other species.

The structure of the epidermis in regard to shape and size of the single cells is very nearly the same for all our species, and agrees in most respects with that of L. oryzoides. In L. lenticularis, however, the cells of epidermis underneath the mestome bundles are very thick-walled, and remind one of stereome, when examined in transverse section (fig. 5). The bulliform cells, also, are well developed in these species and show the same arrangement as described for L. oryzoides, with the exception that L. hexandra (fig. 1), possesses groups of these cells between all the mestome bundles and on both faces of the blade; the other species have only two groups on the inferior face, there being one on each side of the midrib, while the superior face shows one group between each mestome bundle (figs. 4, 7 and 8). Epidermal expansions, warts and thorns, are present in large numbers in L. Virginica, L. lenticularis and L. monandra, on both faces of the leaf, as we have seen in L. oryzoides. L. hexandra is much

[1] BOT. GAZETTE **17**: 358. 1892.



HOLM on LEERSIA.

THE
JOHN CRERAR

freer from warts, many of the epidermal cells being entirely smooth, and the thorn-shaped expansions are not so numerous in this species. Long hairs were observed to be characteristic of the variety depauperata of L. hexandra, and the base of these hairs showed a distinct constriction of the inner cell-wall (fig. 3). The hairs occurred especially on the inferior face but only under the mesophyll.

Concerning the stomata there does not seem to be any essential difference from what has been stated in our description of L. oryzoides.

The mestome bundles show the same development and arrangement as in L. oryzoides, with the exception that the small ventral bundle above the midrib is often wanting in L. monandra; the presence of such small bundles on the superior face of the blade is very characteristic of Leersia, and some specimens of L. oryzoides show the presence of as many as three of these bundles above the midrib. The species we describe here did not show more than one bundle, and, as mentioned above, it was wanting in some specimens of L. monandra, which were collected in Texas. There are also three different degrees of development in the mestome bundles of these species and they are characterized in the same way as those of L. oryzoides. A thin-walled parenchyma sheath is present in those of first and second degree, and is generally colorless, except in L. lenticularis, where chlorophyll was observed in the sheath of all the bundles, though not in the median ones. The small ventral mestome bundles are merely surrounded by a mestome sheath. Concerning this sheath (the mestome sheath), it was observed to be present in all the bundles of the species in question, and consists of more or less thick-walled cells, forming a closed ring around the leptome and hadrome. In L. Virginica and L. hexandra, however, the mestome sheath is rather thin-walled, even in the largest, the median bundle; the variety depauperata had, nevertheless, a distinctly thick-walled mestome sheath.

The leptome and hadrome are well differentiated in the largest bundles, where they are separated from each other by a single or sometimes double layer of thick-walled mestome parenchyma, as in L. lenticularis. The smaller mestome bundles, those of second degree, have the hadrome part less developed, and have no layer of thick-walled mestome parenchyma. The ventral bundle is still more reduced and con-

tains only leptome in L. monandra, hexandra and lenticularis. By comparing the development of the mestome bundles of all our species of Leersia it is readily seen that those of L. hexandra (fig. 1), are the strongest, and that they form prominent ribs in connection with the heavy layers of stereome. This species, L. hexandra, possesses also larger groups of stereome than any of the other species in question. In regard to the arrangement of the stereome, however, there does not seem to be any difference between the various species of Leersia.

The mesophyll shows very near the same development and arrangement as we have seen in L. oryzoides. L. hexandra is an exception, however, and the section (fig. 1), shows that this tissue is separated in groups by the large colorless parenchyma.

The colorless parenchyma has therefore its greatest development in L. hexandra, where it is especially observable in the middle of the blade, besides this smaller groups of similar, but somewhat thickened, cells connect the bulliform cells of the dorsal and ventral face of the blade in this same species. The other species of Leersia agree with L. oryzoides in regard to development and arrangement of this form of parenchyma.

By considering now the leaf-structure of the genus Leersia the following characters may serve for the discrimination of the species:

Epidermis.

Hairs on the inferior face outside the mesophyll	*L. oryzoides.* *L. hexandra*, var. *depauperata.*
Bulliform cells forming groups between all the mestome-bundles on both faces	*L. hexandra.*
Epidermal-cells of the inferior face outside the mestome-bundles very thick-walled with narrow lumen	*L. lenticularis.*
Epidermal-cells very warty	*L. oryzoides.* *L. Virginica.* *L. monandra.* *L. lenticularis.*
Epidermal-cells often perfectly smooth	*L. hexandra.*

Mestome-bundles.

From one to three small bundles above the midrib	*L. oryzoides.*

Only one small bundle above the midrib	*L. hexandra.* *L. Virginica.* *L. lenticularis.*
Sometimes no small bundle above the midrib	*L. monandra.*
Parenchyma-sheath chlorophyll-bearing in all the mestome-bundles excepting the median-ones	*L. lenticularis.* *L. oryzoides.*
Mestome-sheath thin-walled	*L. Virginica.* *L. hexandra.*

Mesophyll.

Separated in groups by large uncolored parenchyma	*L. hexandra.*

Colorless parenchyma.

Forming groups which connect the bulliform cells of the superior and inferior face	*L. hexandra.*

U. S. Dep't of Agriculture, Washington, D. C.

Explanation of Plate XXVI.

Sections of leaves of *Leersia hexandra, L. lenticularis, L. Virginica* and *L. monandra.*

Fig. 1. *L. hexandra* (North Carolina). Transverse section of the middle of the blade. The black part represents the mesophyll. × 75.—Fig. 2. Same species (Texas). Transverse section, showing the bulliform cells and the colorless parenchyma between two mestome-bundles. *S. F.*, the superior face. × 320.—Fig. 3. The variety *depauperata* of *L. hexandra* (Florida). The base of a hair from the inferior face of the blade. × 320.

Figs. 4–6. *Leersia lenticularis.*

Fig. 4. Transverse section of the middle of the blade. × 75.—Fig. 5. Bulliform and thick-walled epidermal-cells; the last from underneath a mestome-bundle. × 320.—Fig. 6. Colorless parenchyma from the midrib, bordering on the mestome-sheath (*M. S.*). × 320.

Fig. 7. *Leersia Virginica.* Transverse section of the middle of the blade. × 75.

Figs. 8–10. *Leersia monandra.*

Fig. 8. Specimen from Texas. Transverse section of the middle of the blade. × 75.—Fig. 9. The median mestome-bundle; *J. F.*, the inferior face, *M. S.*, the mestome-sheath. × 320.—Fig. 10. Specimen from Florida. A small mestome-bundle above the midrib, surrounded by a mestome-sheath (*M. S.*), but only containing leptome. × 320.

Daniel Cady Eaton.

GEORGE E. DAVENPORT.

WITH PORTRAIT; PLATE XXVI A.

The death of this eminent pteridologist, who has been for so many years our leading authority on the ferns, will be felt most keenly by all who love those beautiful plants with which his name has been so long associated that we cannot think of them without thinking of him, and it will be a long time, a very long time before we become reconciled, if we ever do, to his loss.

There are always some with whom one does not like to associate thoughts of death. The places which they fill and adorn seem to be so essential to the good and happiness of others that we wisn to think of them as being always with us, an ever living presence. But when the sudden taking away of such awakens us, however rudely, from this dream, and when the shock of the blow which stuns for the moment passes away, we happily find that we are left with the heritage of a memory sweeter and more precious far than even the living presence, and with a richer benediction that is immortal in its influence. Among such we can always think of Prof. Eaton as a conspicuous example.

Charles C. Frost, of Brattleboro Vt., who made his name famous as a botanist while working at his trade as a shoemaker, once told a friend of the writer that Prof. Eaton first had his attention called to the ferns during a woodland stroll by the young lady to whom he was engaged, and who subsequently became his wife; and that the desire to aid her led to his becoming so much interested in the ferns as to make of their study the specialty which has given to his name the reputation it has since borne. If this be true, we owe to her an everlasting debt of gratitude, and our hearts will go out to her with stronger and deeper sympathy in the great sorrow which has come to her now.

It is certain, however, that Prof. Eaton must have inherited a love for botany. His grandfather, Prof. Amos Eaton, of the Rensselaer Institute, Troy, N. Y., was one of the pioneers of American botany. He published between the years

DANIEL CADY EATON

1816 and 1840 a number of important botanical works that ran through several editions, including some catalogues of local floras, a botanical grammar and dictionary, botanical exercises, and manuals of the northern states, and of the United States, the latter, revised in 1840 in conjunction with J. Wright, being known as the "eighth edition of Eaton's Manual." His father, General Amos B. Eaton, a distinguished military officer, was also interested in scientific pursuits, and made some fern collections that were subsequently included in his son's account of "The ferns of the southwest," published in Wheeler's report in 1878. So that Prof. Eaton may be said to have been well equipped by inheritance for the work which he had undertaken to do. That he rendered a good account of the talents thus entrusted to him is evident from the splendid record which he has left for others to admire and emulate.

It is probably not generally known that Prof. Eaton had a cousin younger than himself, bearing precisely the same name, who was for some years professor of the history and criticism of art at Yale. In consequence of this fact the two professors have sometimes been confused. It is probably for this reason that the erroneous statement of his having been born in Johnstown, N. Y., has been published, as well as the statement that his name appears on the Yale "roll of honor" as private in the seventh New York regiment, although he did serve for several years as inspector of stores at New York city in the United States commissary department during the war.

Prof. Eaton was, however, born at Fort Gratiot, Michigan, September 12, 1834, and was the son of General Amos B. Eaton and Elizabeth Selden, of Rochester, New York. His father distinguished himself in the Seminole and Mexican wars, becoming major by brevet after Buena Vista, and subsequently brigadier-general.

He entered Yale College in 1853, and graduated in 1857 with a class noted subsequently for its distinguished members. A year previous to his graduation he contributed to the *American Journal of Science* a short paper on "Three new ferns from California and Oregon." Immediately after graduation he entered Harvard as a member of the Lawrence Scientific School, where he began the systematic study of botany under Prof. Asa Gray.

Here was formed that intimacy and friendship between two kindred natures which continued without interruption until the death of Dr. Gray, and which led him to dedicate to his revered instructor and friend, his magnificent work on "The Ferns of the United States of America and British North American Possessions," published in 1879–80.

In 1860 Prof. Eaton received the degree of bachelor of science from Harvard, and in 1864 he was elected professor of botany at Yale, with duties chiefly in the Sheffield Scientific School, where he remained until his death.

Previous to this time he had published papers on the ferns of Japan, and eastern Cuba, and contributed the chapter on Filices to Chapman's "Flora of the southern United States." During the thirty-one years of his professorship at Yale he published more than sixty papers, mostly on the ferns, mosses and algæ, with an occasional diversion, as in his "Vegetable fibres in an oriole's nest;" "Tea, coffee, and chocolate; their nature and their effects;" and his botanical definitions in Webster's "International dictionary."

In 1867 he elaborated the ferns for the fifth edition of Gray's "Manual of the botany of the northern United States," and the "acrogens" for Gray's "Field, forest and garden botany" a year later, continuing the revisions through all subsequent editions of those works to the present time.

Two of his most important works of this period were his report on the Compositæ in Watson's "Report on the botany of the geological survey of the fortieth parallel under Clarence King," published in 1871, and his splendid elaboration of the ferns for Lieut. Wheeler's "Report on the United States geological surveys west of the 100th meridian," published in 1878. It was in this latter work that *Notholæna Hookeri* was elevated to specific rank and dedicated to Dr. Hooker who had previously treated it as a variety of *N. candida* under the name of *fido-palmata*. The entire scope of this elaboration was broadened so as to include all the ferns known to have been collected west of the 100th degree of longitude, and south of the 40th degree of north latitude, under the head of the "Ferns of the southwest."

This work was supplemented later on by an elaboration of the vascular cryptogams for the "Botany of California" published in two volumes under the direction of Sereno Watson. One of the writer's botanical treasures is a nearly complete

proof copy of Prof. Eaton's share of this work from his own hands. Not the least valuable of Prof. Eaton's many papers have been his notes on "New and little known ferns of the United States," which have appeared inthe *Bulletin* of the Torrey Botanical Club from time to time, and which have always been anticipated eagerly by botanists, while his check list of ferns has been invaluable as a medium for exchanges.

Latterly he has been engaged with Edwin Faxon and others in preparing for distribution fascicles of the sphagna, and from January, 1891, to April, 1895, has contributed reviews of botanical works to *The Nation.*

A complete enumeration of his many papers, or an extended notice of even a portion of them here is out of the question in a notice necessarily brief, however much one might be inclined to dwell upon it, but it is not too much to say that the one monumental work by which he will always be best and most popularly known and remembered is the grand work on our North American ferns published in two superb volumes in 1879–80. It is much to be regretted that a third volume could not have been added to that splendid publication, to include the fern allies, out of the abundant material which has accumulated since the last part was issued.

Of Prof. Eaton's personality it is not possible to speak except in the very warmest terms of admiration. His was a regal nature possessing that true nobility of soul which subordinates self wholly, and is ever ready to acknowledge and correct errors of judgment.

It was this quality, the readiness with which he would always reconsider and carefully weigh evidence for or against any position he may have taken, that endeared him to the writer, who, though seldom having the pleasure of a personal meeting, yet through frequent correspondence extending over a period of some twenty years, had come to entertain for him the very highest regard.

It has been well said of Prof. Eaton that he was ever ready to aid those seeking light. "He was singularly but unobtrusively helpful in every social relation, generous and tender in his charities, and always eager with some self-sacrificing act of neighborly kindness."

For the passing away of such a man there can be but one sincere feeling, that of deep regret, and sympathy for those who remain.

Medford, Mass.

The nomenclature question.

A further discussion of the Madison rules.

In the preceding number of the GAZETTE, Mr. Coville attempts to waive an objection to the Madison rules, on the ground that the occurrence of such cases as I had presented, was a matter of "almost ridiculous improbability." To prove his point he has referred to the union by Dr. Kuntze of various genera with Aster, implying that it did not lead to the results depicted. It scarcely need be said in reply that of course it did not, because Dr. Kuntze did not follow the Madison rules. If on the other hand Mr. Coville means to say that the Madison rules, if applied to this combination of genera, would not have led to a number of just such cases as I have illustrated, he is greatly in error. To prove this statement the following examples may be cited.

Dr. Kuntze transfers to Aster, among many other species, *Aplopappus Chamissonis* DC., *A. Palmeri* Gray, *A. Parryi* Gray, *A. spinulosus* DC., *A. Watsoni* Gray, *A. Hallii* Gray, and *Solidago litoralis* Savi. All of these species had specific names, which duplicated younger specific names already in Aster, so that if the Madison rules had been followed the seven species of Aster with later names would all have been rechristened and, as I have pointed out in a former paper, could never, consistently with the Rochester and Madison rules, regain their original names, no matter how soon the genera were again separated. Having thus shown seven cases in point in the very example cited by Mr. Coville to prove their non-existence, I may leave it to the botanical public to judge whether the occurrence of such instances is of ridiculous improbability and whether Mr. Coville has really made any satisfactory answer.

In place of further argument, my critic has attempted to give to the discussion an unwarranted personal turn, which I greatly deplore. He accuses me of making a "depreciatory allusion to the botanists of the Madison meeting of the American Association both as to their number and their standing." The only portion of the paragraph, which he cites, which could possibly be so falsely interpreted, is as follows: "Considering that the 'List of Pteridophyta and Spermatophyta' has not to my knowledge received as yet the formal sanction of any considerable or representative body of American botanists," etc. When I wrote this I certainly had

not the remotest thought of its being applied to the Madison gathering, and I can scarcely see how my critic can maintain that my words have the compromising purport which he ascribes to them. Certainly the "List" has not received the formal sanction of the Madison conference, for the simple reason that it was not published, nor in great part even written, until long after the Madison meeting, so that no one, who gave my statement a moment's thought could have read into it any slur upon the members of the Madison convention. It is a well-known and generally established custom for assemblies of all sorts to refer work to committees, but the results of such work cannot be said to have received the formal sanction of the body until the committee has made its report, and the report has been accepted.

While Mr. Coville's examples of the doctrine of homonyms are lucid, the felicitous effect of that theorem is not yet apparent to all. The case may be presented in the following somewhat modified form. When it is found that a valid species has by chance received the same name as an older defunct one, relegated to synonymy, the former is, according to the doctrine of homonyms, to have its name changed at once, while according to the usage now prevalent in all foreign countries and among a number of our own botanists, such a valid species would be allowed to retain its name until there was a practical reason for changing it. This reason could in general only be the revival of the older homonym as a good species, which would certainly not occur oftener than once in four or five times, so that there would in most cases be no occasion for change at all. That the former course, which makes a host of premature changes many of which need never be made, is conducive to greater stability is, to say the least, not self-evident. Mr. Coville advocates immediate renaming in case of all such homonyms for the rather singular reason that future specialists doing critical work may not have to disturb nomenclature. But would it not be safer to entrust such changes to the specialist when he has in due time demonstrated that they are necessary than to the enthusiastic reformer, whose basis of action is only a theory of botanical language as yet endorsed only by a small part of the active botanists of the world? Certainly we should scarcely need a better example of the difference between the theoretical and practical in nomenclature, a distinction already brought out in the recently published recommendations and quite clear to many of our American botanists.—B. L. ROBINSON.

BRIEFER ARTICLES.

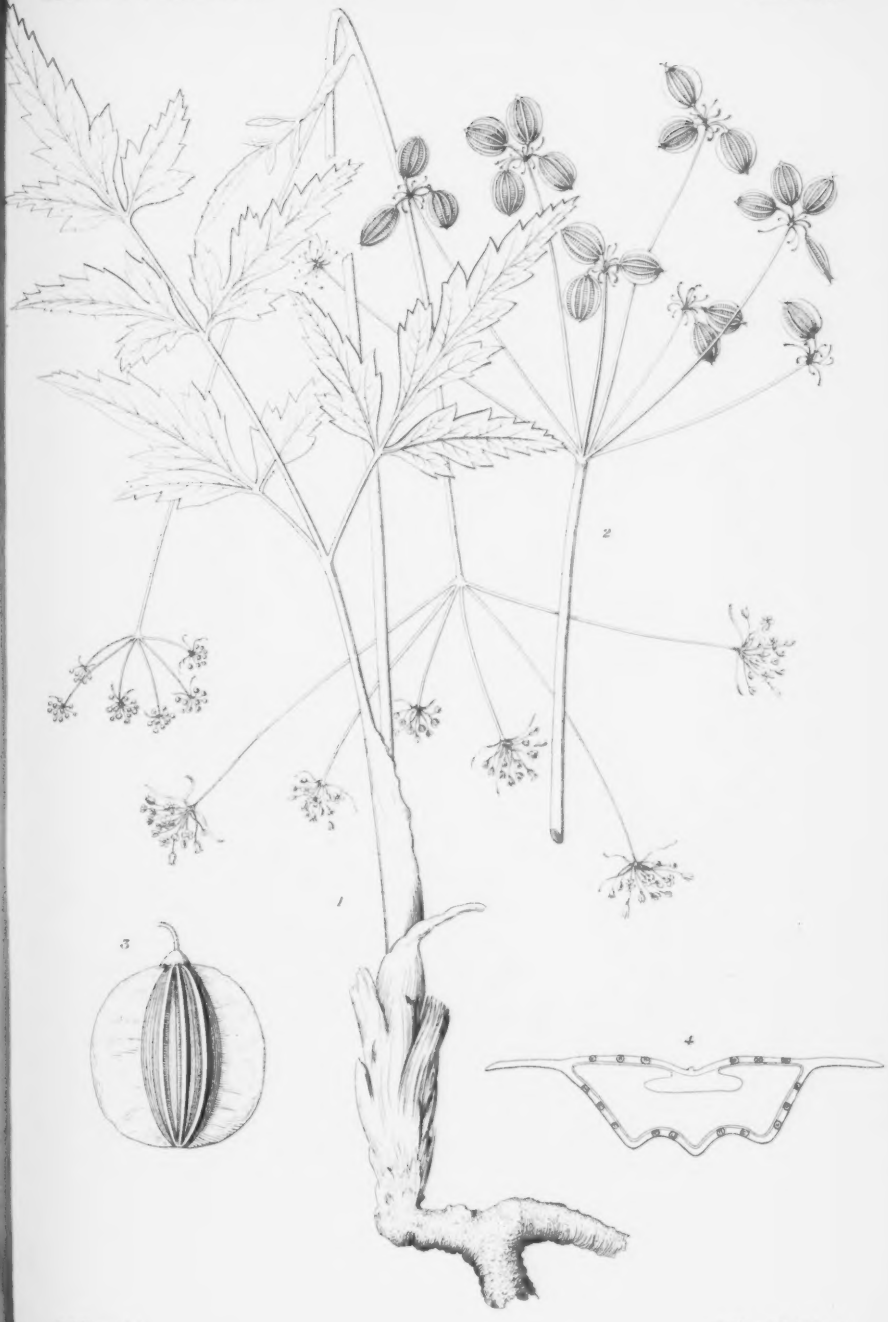
Deanea, a new genus of Umbelliferæ from Mexico.—(WITH PLATE XXVII.)—We have just completed a report upon what is perhaps the largest and most valuable collection of Umbelliferæ ever made in Mexico. This collection, the joint work of Mr. E. W. Nelson, of the Department of Agriculture, and of the veteran collector, Mr. C. G. Pringle, of the Gray Herbarium, comprises more than fifty species and contains four undescribed genera. One of these, *Neogoezia*, has recently been published by Mr. W. Botting Hemsley, of Kew Gardens. We now present a description and illustration of a second one.

Deanea, n. gen. (PEUCEDANEÆ.)—Calyx-teeth obsolete. Fruit oval, glabrous, with 2-parted carpophore and broad conical stylopodium bearing a short style. Carpel, with dorsal and intermediate ribs thickened, filiform; lateral wings broad and thin, surrounding the fruit. Oil-tubes, one to three in the intervals, six to eight on the commissural side. Seed strongly flattened; the face with a narrow sulcus which connects with a narrow cavity extending laterally across the face of the section, making a strongly involute seed.—Short caulescent perennials, with filiform or tuberous roots, ternately or pinnately dissected leaves, involucre wanting or of a single bract, involucels of small linear bractlets, and purple flowers.

There is a general resemblance in habit to *Rhodosciadium* Watson, but the obsolete calyx-teeth, more prominent stylopodium, and especially the peculiar cavity of the seed face, plainly separate it. *Prionosciadium* Watson has a somewhat similar seed-face, but its species are high caulescent, even shrubby plants, with much larger and more prominently ribbed fruit, depressed stylopodium and short calyx-teeth.

The genus is dedicated to Mr. Walter Deane, of Cambridge, Mass., whose interest in American botany and botanists deserves commemoration.

Deanea nudicaulis, n. sp.—Shortly caulescent or acaulescent, 3 to 5^{dm} high, from thick branching roots: radical leaves dark green, two to three times ternate; leaflets ovate, lobed and toothed, acute, glabrous; stem leaves reduced to inflated sheaths, with one to three small leaflets, often opposite: fruiting rays (three to eight) spreading, 2.5 to 5^{cm} long, slightly scabrous on the angles: pedicels 3 to 6^{mm} long: fruit 5^{mm} in diameter; wings thin, as broad or half as broad as body; oil-tubes three to four in the intervals, six on the commissural side.



C.E. Faxon del. B. Mansell, Lith. Boston.

DEANEA NUDICAULIS Coult. & Rose, nov. gen. et sp.

Collected by Mr. C. G. Pringle, on the Sierra de San Felipe, altitude, 7,500 to 10,000ft, May 28, 1894, and August 3, 1894, no. 4,663; and by E. W. Nelson, on the Sierra de San Felipe, at an altitude of 10,000 to 11,000ft, September 20 to 30, 1894, no. 1,087.

Deanea tuberosa n. sp.—Shortly caulescent, 5 to 7.2dm high, from a globose tuber: leaves twice pinnate; leaflets sharply toothed or cleft into linear segments, slightly scabrous beneath: peduncle 2 to 3dm long: rays five to eight, unequal, 1.2 to 5cm long; pedicels 2mm long: fruit about 6mm in diameter; wings thin, about as broad as body; oil tubes one to three in the intervals, six to ten on the commissural side.

Collected by Mr. C. G. Pringle in low meadows, valley of Toluca, Mexico, Oct. 3, 1892, no. 4,295. This plant was distributed by Mr. Pringle as a *Rhodosciadium*.—John M. Coulter and J. N. Rose, *Lake Forest and Washington.*

Explanation of Plate XXVII.—Fig. 1, flowering specimen; fig. 2, fruiting umbel; fig. 3, dorsal view of carpels; fig. 4, cross section of the same; figs. 3 and 4, somewhat enlarged.

The pignuts.—There is some question as to the exact distribution of the common pignut (*Carya porcina* or *Hicoria glabra*) and the related *Carya* or *Hicoria microcarpa*, and the undersigned will be grateful for herbarium specimens and especially nuts with their husks, representing both. In the recently published seventh volume of Professor Sargent's Silva, the range of *glabra* is given as southern Maine to southern Ontario, through Michigan to southeastern Nebraska, southward to the shores of the Indian River and Peace Creek in Florida, and to southern Alabama and Mississippi, through Missouri and Arkansas to eastern Kansas and the Indian Territory, and to the valley of the Nueces River in Texas. *H. microcarpa* (treated in the Silva as a variety of *glabra*, under the varietal name *odorata*) is said to occur in eastern Massachusetts, Connecticut, eastern and central New York, eastern Pennsylvania, Delaware, the District of Columbia, central Michigan, southern Indiana and Illinois, and Missouri.—William Trelease, *St. Louis, Mo.*

EDITORIAL.

UNDER THE CAPTION "American nomenclature," the editor of the *Journal of Botany* prints in the July number a portion of a private letter from some American correspondent in which occurs the following:

"The only two botanical journals are controlled by reformers. . . . The journals in question will not accept articles which give a true account of what has been said against the American system in Berlin and Vienna. A notice stating the facts was sent to *Science*, and . . . suppressed. It was then sent to the BOTANICAL GAZETTE, but was declined."

Inasmuch as the editor has sufficient grace to recognize this charge of suppression of the truth as a serious one, it would seem to have been his duty to determine whether it was true or false before publishing it. He could hardly have failed to observe that the GAZETTE has been publishing articles adverse to the reform movement in nomenclature, and had he re-examined them he would have found four of the six on this topic by opponents of reform and only two in favor of it. Another, likewise adverse, is published in this number. We challenge our readers to say whether this shows a spirit of fairness or a desire to suppress discussion. Does it even indicate an inclination to refuse "articles which give a true account of what has been said against the American system?"

So much the editor of the *Journal* could have inferred from the action of the GAZETTE. It is enough to raise at least a presumption that his correspondent's statement was untrue. But he prefers to assume that what the GAZETTE has rejected has been rejected for the purpose of suppressing the truth.

AS A MATTER of fact the GAZETTE has rejected but one article on the subject of nomenclature. The article "suppressed" by *Science* was rejected by us because it contained numerous objectionable personalities. In returning the MS., we took pains to inform the author that we objected only to the personalities, *not* to his opinion on nomenclature, and that if the personalities were eliminated the paper would be accepted. When the MS. was returned to the editor, however, it had been so greatly amplified that it would have filled at least thirteen pages of the GAZETTE. It was therefore returned to the writer with a request to condense it, and he was offered any space up to five pages (about the space required by the original paper), but he declined to alter the MS., and finally withdrew it.

IT IS DIFFICULT to believe that a wish to be fair to what he is pleased

to call "the arbitrary dicta of certain American botanists" animates the utterances of the editor of the *Journal of Botany*. If it does it is at least curious that two scientific men should come to such opposite conclusions upon the same facts as do Mr. James Britten and a strenuous but gentlemanly opponent whose name we withhold but whose voluntary words we are permitted to quote:

"I have greatly regretted the ill-natured statements of J. Britten, especially those in which he implies that there has been any unfair suppression of opinion by the GAZETTE. I am confident that whatever has been rejected by the GAZETTE has been refused for the best reasons and for the sake of harmony and the best good of all concerned."

CURRENT LITERATURE.

The fertilization of Flanders flowers.[1]

In the first part of the introduction the author gives a review of the literature of fertilization and pollination, considering the works of Camerarius, Koelreuter, Sprengel, Darwin, Hildebrand, Delpino, Axell, Müller, Loew, Burck, Weismann, Wallace, and others. In the second part it is insisted that too much importance has been attached to the colors of flowers, and that many characters regarded as adaptations to insects can be otherwise explained. This part also contains a discussion of the Knight-Darwin law, and of the theory of Naegeli, and observations on methods of elucidation of floral mechanisms.

The body of the work, (pp. 130–562), contains descriptions of the indigenous, and some cultivated, species, original and accompanied by many original illustrations, or based on the authority of persons cited. The insects observed on flowers of the entomophilous species are given in each case. The remainder of the work is concerned with general considerations and is followed by a résumé in French.

The region is characterized by being low, having numerous slow streams, frequent rains, fertile soil, mild winters, and summers of moderate heat. There are many anemophilous plants, 215 in a total of 675 species, and few flower-loving insects. In a region which is said to be the most densely populated of the most densely populated country of Europe, the influence of man must be considerable, and this factor is justly estimated by the author.

MacLeod records the results of extensive observations upon the

[1] MCLEOD, DR. JULIUS.—Over de bevruchting der bloemen in het Kempisch gedeelte van Vlaanderen. pp. (1–694). Figs. 125. Ghent. 1894. Reprint from the Botanisch Jaarboek **5**: 156–452. 1893.—**6**: 119–512. 1894.

phenological positions of the anemophilous flowers, as well as the entomophilous flowers and anthophilous insects. It may be worth while to compare these results with those obtained in Illinois, as regards the seasons of some dominant families, giving the number of species in bloom in each month. In the following table, under each family, the first figures are for Flanders, the second for Illinois.

Family.	*No. sp.*	*Mar.*	*Apr.*	*May.*	*June.*	*July.*	*Aug.*	*Sept.*
LILIACEÆ	11	..	2	8	6	2	2	1
	17	1	9	12	6	3	..	..
ORCHIDACEÆ	11	..	..	3	10	7	..	..
	6	..	..	4	2	1	..	1
POLYGONUM	10	..	..	1	4	10	9	6
	11	..	..	.	3	8	11	11
RANUNCULACEÆ	19	..	5	15	17	13	9	5
	19	3	11	14	10	4	2	..
CRUCIFERÆ	31	1	13	25	28	19	14	9
	13	..	9	12	7	5	3	3
ROSACEÆ	24	..	8	15	19	12	9	3
	23	..	8	16	14	8	4	4
LEGUMINOSÆ	31	1	2	14	27	26	23	17
	37	..	2	7	12	20	25	16
UMBELLIFERÆ	26	..	..	7	16	23	23 (1)	13
	19	..	4	12	12	6	4	3
GENTIANACEÆ	6	..	..	1	2	5	5	4
	4	..	..	1	1	1	1	2
BORRAGINACEÆ	11	..	1	10	11	8	5	4
	4	1	3	3	2	1	1	1
LABIATÆ	28	2	5	8	18	24	24	20
	23	..	..	3	8	16	18	18
SCROPHULARIACEÆ	27	2	5	12	22	24	19	13
	20	..	3	8	9	8	11	9
COMPOSITÆ	65	4	5	9	32	63	60	49
	86	..	3	9	17	41	64	75

A comparison of the groups will show that the maxima of the more highly specialized approach more nearly those of the less highly specialized than is the case in Illinois. Several families show June maxima, which is not true of any of them about Carlinville, Ills. The curves given in the *American Naturalist*, Feb. 1895, are based on the actual phenological positions of the plants as indicated in lines representing the blooming periods. This gives quite different results from those obtained by estimating the number of species in bloom during the month. For example, in the table I give nine species of Scrophulariaceæ in bloom in June. There are three species which go out of bloom early in the month and three which come in late, and these are separated by an interval in which only three species are in bloom. My curve for Scrophulariaceæ, therefore, shows a June depression. It will be observed that the maximum number given by MacLeod ap-

proaches more nearly the total number of the species in each group. This seems to indicate long blooming seasons, for it is not often that these numbers approximate except when the seasons are long, so as to bring most of the species under the maximum point. Long seasons, on the other hand, may indicate that the natural conditions of competition have been disturbed and that the plants are assuming the habits of introduced plants. As a rule, modification of the flowering season must result inevitably in an alteration in the character of the insect visits.

The seasonal development of the insect groups resembles what I have observed for Illinois. The lower Hymenoptera (allotropic) reach their maximum in June, while my observations indicate a maximum in July, and it may prove to be even later. The *hemitrope* Diptera agree in showing a late maximum, but in Illinois the Syrphidæ preponderate early.

Warming has shown that in Greenland, where flower insects are less abundant, the plants with rich vegetative reproduction are adapted to cross-pollination, while those lacking this power of multiplication are self-pollinating. The former may hold their own, at least for a considerable time, if pollination fails, but in the latter failure to pollinate must soon result in extinction. According to MacLeod certain sacrifices must be made in order to attract insects. The materials which serve for the production of nectar and attractive odors are derived largely from reserves which the plant holds when the flowering season commences. If these reserves are considerable, the plant will attract numerous insects and will become adapted to cross-pollination. If, on the other hand, the reserve materials are slight, the plant can use only a small part of them for the attraction of insects, a greater part being reserved for the nourishment of the fruit and seeds. The expenses in that direction being limited, the flowers are less likely to be visited by insects, and accordingly will self-pollinate more frequently. For this reason, the author divides the plants into two sets, capitalists and proletaires, the former consisting of trees, shrubs, herbaceous perennials, biennials and some annuals, the latter containing most of the annuals. It is admitted that a reduction of capital results from a shortening of life, in which man is an important factor. The proletaires are found almost exclusively upon cultivated lands where as a rule it is impossible for the capitalists to endure. They offset the disadvantages arising from the continual disturbances of the soil by a great fertility. On lands which for some time are not disturbed by cultivation MacLeod observes that the proletaires are rapidly crowded out by the capitalists. The self-

pollinated plants thus show an advantage over the cross-pollinated only under the pseudo-ecological conditions induced by the hand of man. This disposes of one of the objections of the apostles of self-pollination who have long been distinguished for a facility in mixing heterogeneous data.

On the relation between the mode of pollen transfer and the structure of fruits, the author calls attention to the fact that in wind-pollinated plants, in a great majority of cases, the fruit is one-seeded or few-seeded, while among entomophilous plants the fruit is commonly many-seeded. This is explained as owing to the fact that in the latter case the pollen is more readily carried in quantity sufficient to fertilize many ovules. Among the indigenous plants *Populus* and *Juncus* are the only anemophilous species which are polyspermous. The case of *Juncus* may be explained by the fact that many of the species can self-pollinate. That of *Populus* may be accounted for on the hypothesis that the plants are descendants of entomophilous forms. I suspect that this hypothesis may be shown to be quite probable. Warming has observed that in the Arctic regions *Salix* shows a disposition to resort to anemophily, and this will support us in the supposition that *Populus* has gone through an entomophilous stage. To the indirect agency of insects, therefore, it seems that we must attribute the development of the great variety of polyspermous dehiscent fruits. The theory suggests that the union of many pollen grains in compact masses, as a favoring condition, may explain the development of a high degree of polyspermy in the orchids.

MacLeod has produced an admirable work which well deserves being cited by Willis[1] as a model of this kind of investigation.—CHARLES ROBERTSON.

Minor Notices.

ANOTHER VOLUME in the botanical series of Ostwald's Classics[2] introduces the reader to Andrew Knight[3] and his writings. Six of Knight's interesting articles from the Transactions of the Royal Society, beginning with that most famous one of all which proved that roots and stems take their position in response to gravity, are given, followed by a brief sketch of his life, notes by the translator, and an enumeration of 93 titles of articles on plants published between 1795 and 1838. Knight wrote in a very attractive way, and for many reasons these essays are rightly considered classical. This neat little volume merits a warm reception from the public.

[1] The Natural History of the Flower. Natural Science **4**: 351. My 1894.

[2] Earlier numbers are reviewed in this journal, **19**: 207.

[3] KNIGHT, THOMAS ANDREW.—Sechs pflanzenphysiologische Abhandlungen (1803–1812). Uebersetzt und herausgegeben von H. Ambronn. Ostwald's Klassiker der exakten Wissenschaften, Nr. 62. 12mo. pp. 63. Leipzig, Wilhelm Engelmann, 1895. *M*1.

NOTES AND NEWS.

DR. G. J. PEIRCE, who has been reading in the botanical libraries at Harvard during the past year, takes the place of Prof. Mottier in Indiana University while the latter goes abroad.

MR. W. C. MCDONALD of Montreal has presented thirty-five acres of ground, conveniently situated and suitable, for the use of the botanic garden in connection with McGill University.

DANIEL CADY EATON, professor of botany in Yale University, died at his residence in New Haven, Conn., on June 29th, after a long illness. A biographical sketch is printed elsewhere in this number.

MR. B. M. DUGGAR AND MR. W. H. RUSH have received the degree of Master of Arts from Harvard University. Mr. Duggar is to join the staff of the Agricultural Experiment Station, Champaign, Ill., and work on entomogenous fungi; Mr. Rush goes to Washington University, St. Louis, Mo., as general instructor in botany.

THE CELEBRATED Japanese lac with which the finest lacquering is done is produced from the latex of species of Rhus. M. G. Bertrand has pointed out (Compt. Rend. **118**: 1215. 1894) that the hardening and blackening of this material, upon which its use as lac depends, is not due to a sudden oxidation alone, but also to the operation of a ferment, laccase.

DANGEARD thinks that he has discovered the sexual process in Ascomycetes. In *Peziza vesiculosa* he has seen two thick filaments lying near each other, and at the tip of each a terminal cell with a nucleus is cut off. These cells copulate and their nuclei fuse. Then the "egg" thus fertilized sends out a prolongation which becomes an ascus into which the nucleus wanders and divides to form the spore nuclei. Cf. Compt. Rend. **118**: 1065. 1894.

HENRY HOLT & CO. announce the publication in December of the second volume of Beal's "Grasses of North America." This volume is to contain descriptions of about 1,000 species and varieties of grasses, native and introduced, with carefully drawn illustrations of at least one species of each group, together with a chapter on the geographical distribution of the plants of this family and a list of some of the most important contributions to their study.

THE DOCTOR'S DEGREE was conferred upon three candidates in botany at the recent Harvard commencement. The recipients were E. A. Burt, thesis: The development of the receptaculum in the Phalloideæ; B. M. Davis, thesis: Considerations on the carposporic type of reproduction; H. M. Richards, thesis: On some points regarding the morphology and parasitism of certain Uredineæ. Dr. Burt goes to Middlebury College, Middlebury, Vt., as Burr professor of natural history; Dr. Davis to Chicago University, as instructor in cryptogamic botany. Dr. Richards has been appointed to a Parker travelling fellowship, and is to study abroad, at Leipzig.

AN INTERESTING USTILAGO on Zizania latifolia was described by P. Hennings in *Hedwigia* (34: 10). It is sold in the markets of Tonkin as a vegetable. In the May number of the Tokyo *Botanical Magazine* K. Miyabe gives an account of it as it appears in Japan, where it is gathered and sold, but not for eating. Japanese women color the eyebrows and hair with the spores mixed with oil. The spores are more largely used in the lacquer industry to produce rusty colored wares by mixing with lac. The smut is also interesting for its development. It starts in the terminal meristem when the shoot is young. The culm remains short, but the spore mass enlarges to four or five inches in length and three fourths of an inch in thickness. The spores are massed into peculiar small granules in cavities in the tissues of the host.

ERIKSSON'S studies on the forms of rusts on cereals deserve special attention. In collaboration with Henning he has already[1] called attention to the extensive development of forms among the different species. These forms differ not only in slight morphological characters, such as the structure or dimensions of the spores, but also in the fact that infection with uredospores from a certain species of grass will be efficient in producing disease in the same host species, and not as a rule in other species of grasses. In a later paper[2] he shows that in five species of Puccinia, growing on thirty-five species of grasses, twenty-two forms can be separated with greater or less certainty. The correctness of such distinctions has been sustained by the negative results of experiments in which he sought, by using the aecideal form as a bridge, to transfer the forms to other hosts than those to which they are specially adapted. It will be readily seen that these experiments open up questions of great physiological and taxonomic significance.

ON ACCOUNT of serious financial difficulties and a distrust of the progressive and enlightened educational policy of President John, the trustees of DePauw University, at Greencastle, Indiana, have forced the resignation of the president and set about a return to the old paths. The department of biology having been founded by Dr. John was among the first to suffer. It was summarily abolished, the announcement being made, without previous warning, only the day before commencement. From a professor of zoology and one of botany at the beginning of the last college year, the instructional force is reduced to a single tutor, who is expected to give instruction in the elements of both sciences. Dr. Lucien M. Underwood. whose ability and success as professor of botany have won him the high esteem of both faculty and students, has sailed for Europe and will return in the autumn with his family, who have spent the past year in Germany. He will take up his residence in Syracuse, N. Y.

[1] Zeits. f. Pfl.-Krankh. **4**: 71. 1894.

[2] Ueber die Specialisirung des Parasitismus bei den Getreiderostpilzen. Ber. d. deut. bot. Gesells. **9**: 291. 27 D 1894.

WALKER PRIZES IN NATURAL HISTORY.

By the provisions of the will of the late Dr. William Johnson Walker, two prizes are annually offered by the **Boston Society of Natural History** for the best memoirs written in the English language on subjects proposed by a committee appointed by the Council.

For the best memoir presented a prize of sixty dollars may be awarded; if, however, the memoir be one of marked merit, the amount may be increased to one hundred dollars, at the discretion of the committee.

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1. In all cases the memoirs are to be based on a considerable body of original and unpublished work, accompanied by a general review of the literature of the subject.

2. Anything in the memoir which shall furnish proof of the identity of the author shall be considered as debarring the essay from competition.

3. Each memoir must be accompanied by a sealed envelope enclosing the author's name and superscribed with a motto corresponding to one borne by the manuscript, and must be in the hands of the Secretary on or before April 1st of the year for which the prize is offered.

Subjects for 1896:

(1) A study of an area of schistose or foliated rocks in the eastern United States.

(2) A study of the development of river valleys in some considerable area of folded or faulted Appalachian structure in Pennsylvania, Virginia, or Tennessee.

(3) An experimental study of the effects of close-fertilization in the case of some plant of short cycle.

(4) Contributions to our knowledge of the general morphology or the general physiology of any animal, except man.

Subjects for 1897:

(1) A study of glacial, fluviatile, or lacustrine phenomena associated with the closing stages of the glacial period.

(2) Original investigations in regard to the chalazal impregnation of any North American species of Angiosperms.

(3) An experimental investigation in cytology.

(4) A contribution to our knowledge of the morphology of the Bacteria.

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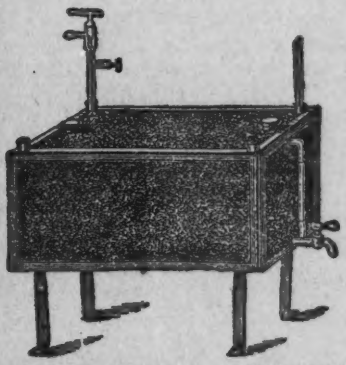

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